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CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—

Annual Meeting American Gas Light Association..... 269

EDITORIALS—

Briefly Told..... 270

A Significant Visit—Which shall Light the St. Paul Court House?

*Critchlow's Improved Apparatus for the Manufacture of Gas..... 271

Notes on Main Laying, by John M'Crae..... 272

Varieties of Clay, and their Distinguishing Qualities for Making Good Puddling..... 275

Special English Correspondence..... 276

The Gas Light and Coke Company—The Truth about Water Gas—Labor in Gas Works.

Concrete Floors, by Frank Caws—Concluded from page 242..... 277

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 279

No More Oil Lamps for Sing Sing, N. Y.—Is an Electric Current a Dutiable Article?—The Damage to Property of the Gas Company by Fire at Spokane Falls—Mayor Fitler Talks about a Municipal Electric Lighting Plant for Philadelphia—The St. Louis Gas Steal—Hartford (Conn.) Public Lighting—President Crockett Finds out about the Naphthaline Pest—Public Lighting, Greenbush, N. Y.—Cleveland may have a Gas Inspector—American Workpeople at the Paris Exhibition—New Gas Company—A Floating Charter, Denver, Col.—Mr. Wanner on the Cast Iron Pipe Market—Good Prices for New Bedford Gas Stock—The Water Gas Plant of the Woonsocket (R. I.) Company—Amended Articles of the Lincoln (Neb.) Gas Company—And Many Other Items.

Report of the Directors of the Gas Light and Coke Company..... 282

Report of the Gas Inspector, District of Columbia..... 283

Radiating Power of Flame..... 283

The Market for Gas Securities..... 283

[OFFICIAL NOTICE.]

Annual Meeting, American Gas Light Association.

LAWRENCE, MASS., July 29, 1889.

Section 12 of the Constitution is as follows:

"12. Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on."

To the Members of the Association: Gentlemen—The Seventeenth Annual Meeting of the Association will be held at Baltimore, Md., on Wednesday, Thursday, and Friday, Oct. 16, 17, and 18. The headquarters of the Association will be at the Carrollton Hotel, which is conducted on the American plan. The meetings of the Association will be held in the Concert Hall of the Concordia Building, on German street near Eutaw.

Members should secure rooms at the hotel by writing in advance to the proprietor. The rate will be $3 per day. Past experience should induce the members to write well in advance for hotel accommodations, and to be very explicit in stating what kinds of rooms are desired. If the members would adopt the further precaution of inclosing in their letters to the hotel proprietors a properly addressed and stamped return envelope, with a request that the writer be informed whether he can secure such accommodation as he desires, much annoyance might be prevented. In the past, members have written to the hotel selected as headquarters requesting that certain kinds of rooms be reserved for them; but the hotel people could not fill the requirements, and had booked them for rooms of a different kind, without notifying the applicant of the change. The members, presuming that silence means consent, come to the meeting expecting to find reserved for them such rooms as they had bespoken, and failing in this have been disappointed. If the members would adopt the hint already given, and request an answer to their applications, trouble on this score might be prevented. In addition to the Carrollton there are other first-class hotels to which members can go if they desire; notably, Rennert's and Mount Vernon, both of which are conducted on the European plan.

The details of the programme for the convention have not as yet been entirely determined; however, it can be stated that the convention will be entertained at dinner the second evening of the meeting, and the last day will be devoted to sightseeing. Further details will appear in due course. That we will not famish for want of mental food is evidenced by the following list of essays to be read at the convention:

"Fuel Gas," by Walton Clark.

"Gas Coals of the United States," by H. C. Adams.

"Care and Operation of Gasholders," by C. L. Rowland.

"Water Gas," by F. H. Shelton.

"Leakage and Condensation," by E. C. Jones.

"Purification of Gas from Kansas Coals," by B. E. Chollar.

"Conduct of the Electric Light Business in Connection with the Gas Industry," by W. H. Pearson.

"Advantages of Supplying a Mixture of Coal and Water Gas," by T. G. Lansden.

"Some Thoughts on Fuel Gas, Induced from Practical Experience in the Distribution of Natural Gas," by John Young.

As in years past, I would advise the members to keep these subjects in their minds; to collect such data in relation thereto as they may be able, and to come to the meeting prepared to discuss these themes.

One word as to the question-box. The Secretary frequently hears the statement that the question-box, if properly used, would be the most useful part of our meetings. If this part of the literary programme of our gatherings is not properly conducted the Secretary would be glad to receive advice from the members, and he will do his best to put into practice any suggestions which may be offered. Members have in years past been invited to send in their questions in advance, so that arrangements may be made to have some one prepared to discuss each conundrum propounded. This invitation is again renewed. I would be very glad to have questions for the box sent in as soon as possible, in order that they may be published in the official notices of the meetings—it is hardly necessary, I presume, to add that the names of the questioners will not be published.

In conclusion, I would remind those thinking of joining the Association at the coming meeting, that under the new Constitution it is necessary that all applications for membership should be in the hands of the Secretary at least ten days prior to the date of the meeting.

Let us hope that the 17th annual will far surpass its predecessors in the volume of attendance and the importance of its discussions. We have on our roll many names the owners of which seldom appear at our conventions; that the absentees thus miss many pleasant hours, and the companies they serve much useful and valuable information, will, I think, be the unanimous verdict of those who habitually attend our gatherings. Respectfully, C. J. R. Humphreys, Sec'y.

BRIEFLY TOLD.

A Significant Visit.—For many years back it has been the pleasant custom of English and American gas engineers to exchange visits, during the progress or carrying out of which a vast amount of valuable information has been mutually imparted. The first visitor to this country, we imagine, who really brought back to England with him the conviction that American gas engineering was something in itself, was Mr. D. Bruce Peebles, who came to this country in the seventies with the express purpose of looking over American gas engineering practice. With his usual candor and fairness, on his return to England Mr. Peebles gave it as his opinion that even England could learn something from America in the matters of gas manufacture and distribution; and since then we have had "calls" from many distinguished English gas engineers, notable among whom were the late Robt. P. Spice, H. F. Jones (of the Commercial Company, London), R. E. Dempster, and last of all, Mr. G. C. Trewby, the managing engineer of the greatest gas works in the world, The Gas Light and Coke Company, of London. Of course these visits, unless it be those of the late Mr. Spice, whose son is a resident of this country, were not directly inspired by social motives, but were taken rather with a view to the observation of certain things connected with the gas industry. For instance, if we mistake not, Mr. Jones visited America at the instance of certain English capitalists, who had been invited to furnish the moneys needed for the absorption by a syndicate of the Boston Gas Company. Mr. Dempster, having successfully concluded a huge contract undertaken by his firm at the order of the Toronto Gas Company, terminated his profitable visit to America by making an illtelligent and extended tour of the country. Next we have Mr. Trewby, who is now here with the especial object of investigating the merits of water gas manufacture. Americans no doubt have watched with amusement the wonderful avidity with which the sanguine British speculator seized and swallowed the bait held out by the British water gas patent rights purveyor, and have also determined that the aforesaid speculator would soon regret his gullibility. Remembering the Gilbertian admonition that "things are not always what they seem," it remains only to be remarked that this admonition carries peculiar force when applied to the recent water gas craze in Great Britian. But now that the haze which the patent rights purveyor had surrounded himself with is about being dissipated by the acquirement of actual knowledge, by well-known, absolutely unprejudiced and perfectly competent authorities, respecting the precise merits of water gas and under what circumstances those merits entitled it to precedence over coal gas, it is matter for congratulation that the speculator of the future in water gas patent rights is about to be protected from himself. While Mr. Jones came over last year in the interest of capital, his inquiring mind and observing eye led him to look into the water gas question, and his subsequent remarks on the subject made to the Directors of the Commercial Company at the ensuing stockholder's meeting, may be said to have given the first great impetus to the study of water gas in England. In the current visit of Mr. Trewby, however, who comes here with the avowed intention of closely observing an actual operation of the various systems of manufacturing water gas and oil, all American engineers must take great interest; for it is quite on the cards that the invasion of the English markets by Russian cheap crude oil is to have a marked effect on the gas making practices of our British cousins. Mr. Trewby informs us that a fairly good grade of Russian crude, suitable for gas enriching, is obtainable in large quantities in London at 2d. per gallon. This rate is not so far away from the price at which Lima crude is deliverable in New York, say, 2¼ cents per gallon. To make the revolution still more in line with possibility comes the fact that labor in English gas works—like unto the labor in every part of the world, no matter what its particular line may be—seems to be disposed to inflict itself with a grievous wound. It demands equal pay for 33 per cent. less hours of duty. As an actual fact the great Company over which Mr. Trewby presides last half year actually arranged with its retort house laborers for 8-hour instead of 12-hour shifts, the precise additional cost to the Company being 20 per cent. above the former practice. Hence, what with cheap oil and dear labor, it would not be surprising if Mr. Trewby could figure out merit in water gas for England. To come back to the labor aspect of the affair, Mr. Trewby undoubtedly by this time has in the course of his ramblings encountered one or more sets of water gas apparatus, standing cold and lifeless, but also acting as potent though grim restrainers of the wilder whims of the laborers who work coal benches hard-by the water gas sets.

Which Shall Light the St. Paul Court House?—The following letter explains itself:

"The St. Paul Gas Light Company,
"St. Paul, Minn., Aug. 15, 1889.

"To the Editor American Gas Light Journal:—In the Aug. 12th number of your valuable Journal I find a rather flattering notice of my examination before the Chamber of Commerce Committee of this city regarding price of gas, etc. The published report was very much garbled, and did not give the full statistics that I furnished—which, I think were quite interesting—and quoted not a few of those which I did give, incorrectly. However, it is not of this that I wish to write. I inclose you a clipping* from this morning's paper, by which you can see we are having a very bitter fight—electric lights vs. gas—for lighting the city buildings. If lit by electricity they will use 1,600 lamps; so you see that it is quite a building. They have probably 40 vaults to be lit all day, and as these vaults have little or no ventilation, the electricians have the advantage of us in this respect, claiming no heat. The committee who award the contract is composed of seven members—four from the City Council, and three from the County Commissioners. The sub-committee, who witnessed last night a test between the comparative cost and the light-giving qualities of gas and electricity, is composed of three members, the chairman of same being the Hon. Walter Sanborn, who is one of the most prominent attorneys in this city and State. I mention this so that you will see that the test is being made by intelligent men. Last evening we measured by meter the number of cubic feet burned by gas jets selected at random in the city buildings by our competitor—the representative of the Edison system. They propose under their contract to furnish 16-candle power lamps. The reading test which I made last night was an ordinary gas jet, 5-ft. burner, that tested just 5 feet as against a 25-candle power incandescent lamp. This sub-committee will report at the next meeting of the Committee, which is to be held on the 30th of this month. I presume the contract will be awarded that day. I will send you a copy of the report whether it is in our favor or against us (and think it will prove interesting reading), as well as the award of the contract. I am making the fight against the electric light with gas at a net price of $1.50 per 1,000. It is a hard fight, but I do not yet give up all hope of winning it. You will please pardon this lengthy letter, but I think these matters are of interest to gas men throughout the country, particularly the decision of a jury of intelligent men. Yours, truly, Crawford Livingston."

*"The contest between the St. Paul Gas Company and the Edison Electric Light Company in the race for the contract for illuminating the City Hall and Court House is intensifying in spicy and acrimonious phases. Last night the special committee on light from the joint committee gave audience once more to the representatives of these warring concerns. The statements of each were drastic, and calculated each to prejudice the service of the other in the minds of the committee. The Edison people ask to make a comparative test of the competing systems, but claim that the burners provided for are not adapted to the Edison system. That is, the lamps are 50 volts capacity, whereas the Edison currents are from 90 to 110 volts, and would burn out the lamps. The committee will report some recommendation at the next regular session, but are not yet agreed as to what the recommendation shall be.

Critchlow's Improved Apparatus for the Manufacture of Gas.

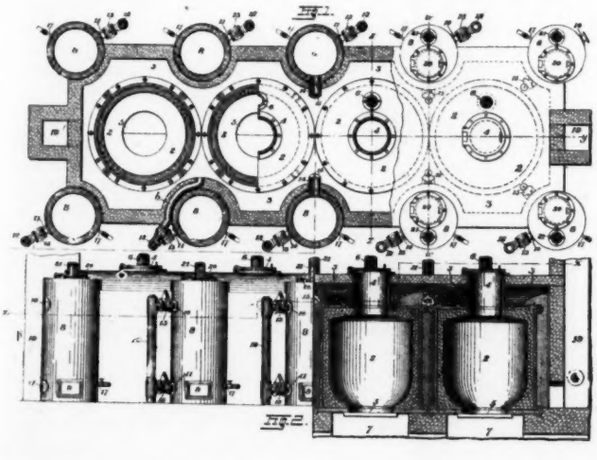
U. S. Letters Patent, No. 406,809, were issued on the 9th ult. to John M. Critchlow, of Beaver Falls, Pa. The following is a copy of the specifications and claims:

This invention relates to an improvement in apparatus for the manufacture of gas, and consists in combining with a water gas producer or cupola a retort for the production of hydrocarbon gas by distillation in such way that the waste product from the water gas producer shall supply the necessary heat to drive the retort, and that the distilled coal from the retort may be used either in whole or in part to supply the carbonaceous charge for the water gas producer, together with means for the production of water gas from the charge in the retort, and for cooling said charge after its volatile gases have been expelled and while it is still incandescent by passing steam through it, and in several other particulars hereinafter noted. In this way both water gas and hydrocarbon gas can be made very economically, utilizing as much as possible the carbon elements of the coal in the production of the gas, and wasting as little as possible in the shape of fuel.

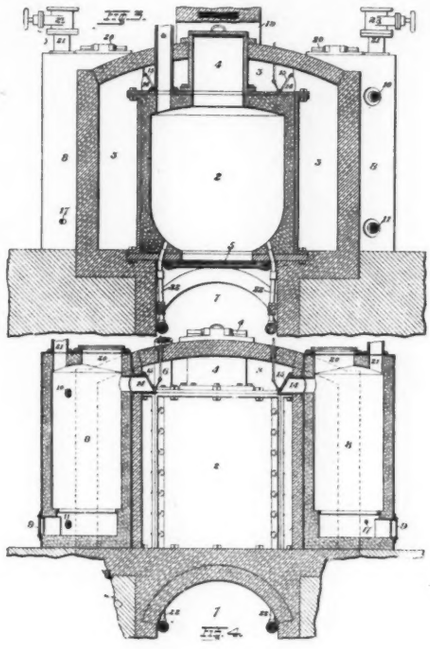
In the accompanying drawings Fig. 1 is a plan view of a gas producing plant embodying the principles of the invention, drawn in section on the line *x x* of Fig. 2. Fig. 2 is a side elevation, partly in section, on the line *y y* of Fig. 1. Fig. 3 is a vertical cross-section on the line *z z* of Fig. 1, and Fig. 4 is a vertical cross-section on the line *w w* of Fig. 1. Like symbols of reference indicate like parts in each.

In the drawings (Figs. 1 and 2) 2 2 are a number of coal distilling retorts, made of iron or other refractory material, and inclosed within a brick chamber or flue, 3. Each retort has a charging hole, 4, at the top, a hole, 5, at the bottom provided with drop-doors, 5*, for drawing the charge, and a gas pipe or outlet, 6, for conveying away the gases produced in the retort. Beneath each retort is a tunnel or vault, 7, by which access is had to the drawing hole, 5. Around the outside of the chamber, 3, are a number of cupolas or gas producers, 8, which are preferably built partly inside the chamber, 3, and are separated therefrom by ihe re-entrant walls of the chamber, which shield the cupolas from the direct internal heat of the chamber. At the base of each cupola is an ordinary ash door, 9. At the top is a charging hole, 20, and an exit pipe, 21 (having a valve, 23,), and at the sides are holes through which branch air pipes, 10 and 11, connected with a main air-blast pipe, 12, enter the cupola. The pipes 10 and 11 have valves, 13. One pipe enters at the base and the other at the top of the cupola. As shown in Fig. 4, each cupola has a discharge pipe or flue, 14, which opens into the chamber, 3, and is provided with a damper or valve, 15, whereby it may be closed from the outside of the chamber, 3. Steam pipes, 17, enter the several cupolas, 8, and are provided with valves.

The operation of the plant is as follows: The cupolas, 8, are charged with coal or coke, and after it is fired the air-blast is turned on through



the pipes 10 and 11, and the cupolas are thus driven until the coal therein reaches a state of incandescence. During this operation the waste heat and partially consumed gases from the producer, mixing with the air from the pipe 10, pass through the flues, 14, in a flame into the chamber, 3, and circulate around the retorts, 2, finally escaping through stack flues, 19, at the ends of the chamber. The retorts, 2, are charged with coal, and the heat communicated to them drives off the vaporizable matter in the coal by distillation, and converts it into hydrocarbon gas, which passes out through the pipes, 6, to the hydraulic main. When the cupolas have been used long enough to raise their contents to an incandescent state, the air-blasts are cut off, the discharge flues, 14, are closed, and steam is admitted into the cupolas through the pipes 17. The steam passing through the body of incandescent fuel is decomposed and converted into water gas (the valves, 23, closed)—hydrogen and carbonic oxide –which is led off through the pipes, 21, to a reservoir, or otherwise utilized. When the cupolas have been used long enough to chill the contained fuel, so that it does not produce water gas, the



valves, 23, are closed, the dampers, 15, opened, and the air-blasts are turned on until the coal is again brought to an incandescent state (the waste heat and burning gases meanwhile passing into the chamber, 3), and the dampers, 15, are then closed, the steam turned on and water gas produced as before. By alternating the firing of the several cupolas, 8, some of them may be kept always producing water gas (the valves, 23, closed), and others discharging their waste heat into the chamber of flue, 3, so that the heat in the chamber may be kept constant.

When the coal in any of the retorts, 2, has been completely gasified and the coal therein made thoroughly incandescent, steam pipes, 22, at the bottom of these retorts may be caused to emit steam into them, and the steam being converted into water gas (the valves, 23, closed) during its passage through the retorts is led off through the pipes, 6, to reservoirs, or otherwise utilized. When the charge in the retorts has become inert, the coke is drawn out through the hole, 5, at the bottom of the retort, and may be charged when hot as fuel into the cupolas, 8. The retort is then filled again, and the process proceeds as before. Each retort is thus caused to alternately produce hydrocarbon gas and water gas, the water gas producers or cupolas furnishing heat for gasifying the coal in the retorts, and the retorts furnishing in whole or in part the fuel necessary for the producers. In this way the heat elements of the coal and producer gas are utilized most completely and economically, and with very simple apparatus. The introduction of the hot coke into the producer also aids materially in the production of the gas.

The inventor does not desire to limit himself to the precise arrangement of the plant shown and described, since it may be modified by the skilled builder. For example, the producers and retorts may be separated from each other by some distance, in which case the air-adits, 10, which are for the purpose of supplying air to complete the combustion of the already partly burned gases from the producer, may be made directly in the chamber, 3, instead of being in the cupola. This is shown at *b*, in Fig. 1, where the air pipe is led through the wall of the chamber. The chamber, 3, may also be changed in form, its purpose being simply to serve as a flue to conduct the heat around the retorts.

The prominent features of the invention are: The production of water gas by passing steam through the retorts after the gases have been distilled, whereby the necessary cooling of the charge in the producer is utilized to produce a valuable gas; also, in placing an air supply either in the producer or in the flue, whereby air is mixed with the

waste gases to produce a more perfect combustion around the retorts; also, in the arrangement of the retorts in a flue common to all the retorts.

The claims made are:

1. The combination, with two or more water gas generators having a common waste product flue, of a coal distilling retort arranged in said waste product flue, so as to be heated by the waste products from the water gas generators, said coal retort having a steam-adit for the admission of steam at or near the close of the distillation of the coal.

2. The combination, with two or more water gas generators having a common waste product flue, of two or more coal distilling retorts arranged in said waste product flue, so as to be heated by the waste products from the water gas generators, said coal retorts having each a steam-adit for the admission of steam at or near the close of the distillation of the coal.

3. In an apparatus for the manufacture of water gas, the combination, with a gas producer, a waste product chamber, a gas retort located in said chamber, steam-adits in the producer and retort, an air-adit at the top part of said producer, the waste pipe of said producer being connected with the waste product chamber, and a damper in said waste pipe for regulating the supply of waste products to the waste product chamber.

Notes on Main Laying.

By JOHN MCRAE.

[Read by the author at the Dunfermline meeting of the North British Association of Gas Managers.]

In appearing before you to-day with this short paper it would be idle for me to begin by apologizing for its brevity, or giving as the reason the want of time available for its preparation. Suffice it to say that, simple as the title is, the paper itself may be found still simpler; and the only motive which has actuated me in laying my few remarks before you is a sincere desire to contribute, even in a small degree, to the usefulness of our Association, and to strengthen the hands of the respected member of our profession who is this year our President. And before entering on my subject permit me here to diverge somewhat, and to say that one of the great difficulties attending the carrying on of this and kindred associations has been the scarcity of papers and paper readers. This part of the business has hitherto been left to a few while many have been the listeners. Where is the gas engineer or manager who has not had his difficulties in carrying on his work? And why is it that, at a meeting such as this, these difficulties should not be ventilated, so that many might be benefited thereby and prepared for similar emergencies? Again, we have all had varied experiences; many have made important researches and subsequent discoveries; where lies the objection to these all being criticised by members of the Association? It occurs to me that the Association was formed chiefly for such purposes, and that the papers read should be of a thoroughly representative character. With this little divergence, I will turn to our subject.

It has always been acknowledged, by those best able to judge, that, in the midst of our many and varied departments, none is of more importance than the distributing. We may have excellent manufacturing apparatus, we may have complete and satisfactory arrangements inside the gas works; but what of that if the article manufactured is not brought to book? We may extract the greatest possible quantity of illuminating gas from the raw material, and the whole process may be conducted on the best known scientific principles; but all is of little value if, by defective distributing mains, a large proportion of the article so manufactured is allowed to go to waste. The case has been very clearly put in "King's Treatise on Coal Gas," where it is said, "The reduction of leakages, in short, is a department of the gas manager's duties in which he should put forth untiring efforts and take especial pride. There is nothing, not even in the proper carbonization of the coal, that will more contribute to the success of the works under his charge and enhance his own reputation." I would add to this statement by saying that there is no part of our duties so widespread, so far beyond our control, and subsequently so difficult to grasp, as the distribution. It must have struck many of you, as it has myself, how mysteriously erratic is the leakage or unaccounted-for gas. It bounds up some years when no explanation can be given, and it falls beautifully in another year; and amidst the congratulations of our employers, one feels, while the result is pleasing, that he has done nothing very special to bring about the improvement.

Much has been written about gas mains, their capacity and the various systems of jointing them. Concerning these you are all perfectly conversant. I have nothing new to add in regard to these items; and it would simply be wasting your time to dwell on them. I have observed, however, during the past few years, that some of the pipes we use are composed of very indifferent cast iron. They may be, and indeed are, of sufficient strength to withstand any pressure the gas passing through them may subject them to; but this is only a very small part of the duty the gas main is called upon to perform. A gas main composed of cardboard, such as the Japanese employ, could be made perfectly gas tight; but what about the external pressure brought to bear on the pipes? It will often be found that the pipes are so brittle that they will sustain comparatively little external pressure, especially if the pipe is lying hollow, and if such external pressure is suddenly applied.

The destruction of gas mains has been very much increased during the past few years by the introduction of that modern appliance, the steam traction engine. Everywhere we find that horse labor is, as far as possible giving place to steam; and this forms one of the points of my "Notes." Supposing we lay a long distance of gas main of any size, and, as a matter of course, the street is not left just as smooth as we found it; the zealous burgh surveyor, anxious at the earliest moment to restore the street to its original beauty, applies his heavy steam roller to the track, with the result that in many cases, owing to the rapid and severe crushing down or consolidation of the roadway, the gas main is subjected to a pressure it is quite unfitted to withstand, and fracture is the result. The service pipes, too, connected as they generally are at right angles to the main, are either disconnected or broken. Now, I suppose it has been ruled that these steam rollers and traction engines are to be considered and classed as ordinary traffic. We must, therefore, see to it that our property shall not be injured by the innovation. I observed lately in the Highlands, where a very beautiful lattice bridge crosses one of our rivers, that at each end of the bridge were placed conspicuous placards announcing to all whom it may concern that this bridge is not guaranteed to carry engines, and that anyone venturing to cross with the fiery monster must do so at his own risk, and not only so, but be responsible for any damage done to the structure by the new method of road locomotion. We have, I suppose, no power to make such stringent regulations; and we must therefore suit ourselves to the times.

In order to guard against these difficulties I would bring forward the following points as worthy of attention: First, I would suggest that all cast iron mains should be composed of iron of a known brand, and, further, that samples of the iron should be taken while the pipes are being cast, and which should be able to withstand a given pressure. Mr. Jas. Watson, the Water Engineer of Dundee, has framed a very good clause which meets the case. It is as follows: "Test bars of the metal being used shall be cast, when required by the engineer or inspector, 3½ feet long, 2 inches deep and 1 inch thick, which shall be supported at points 3 feet apart, and bear a suspended dead weight of 3,360 pounds in the center, for not less than 24 consecutive hours, without breaking; and all pipes cast on any day from metal which will not sustain the specified test shall be rejected." Of course, this may be varied to suit any particular case. Secondly, I would say, have the pipe laid at such a depth as to be as far as possible beyond the reach of the strain caused by such extraordinary traffic. The difficulty will be in fixing this distance; for if the material is solid and firm the depth may be less, and if the subsoil is soft, a greater depth must be adopted. I would say, roughly (for a hard-and-fast rule cannot be given), that a depth to insure 2 feet 6 inches of cover would be found sufficient under ordinary circumstances. With a large trunk main, which is not likely to be disturbed for services or connections, I would lay it much deeper. Another great advantage to be derived from laying the mains at a considerable depth would be their removal from atmospheric variations, and consequently the prevention of excessive condensation of the richer hydrocarbons. This, especially during severe weather, is most important; and, as we rarely find even a severe frost penetrating the ground beyond 2 feet, the depth I have given should be satisfactory.

The next point deserving of notice is the position the pipe should occupy in the street. I would say here, lay the pipe as far as possible from the line of vehicular traffic. I have for some years adopted the practice of laying the gas mains almost under the channel. By doing so no heavy traffic will come near them; they can be lifted and relaid with very little interruption to traffic, and they are very convenient for services. But here a difficulty presents itself. It is all convenient enough for those consumers who are resident on the same side as the gas main, but what about those opposite? If the street is or is likely to become an important one, I would say lay a main on either side of the street, and so avoid what is always a source of great loss and annoyance viz., crossing pipes. If the street has only a few consumers on the side opposite that on which the gas main is laid, then I would have one

crossing main, with a small main running in front of the buildings to be supplied. Avoid crossing mains or services as often as possible.

Now, in regard to the laying of the mains—and you will have observed that what I have said applies to all mains, irrespective of size. Too often the mains (laid probably by a contractor who has no particular interest in the satisfactory and permanent completion of the work) are what I may be allowed to style "flung in." The joints may be carefully enough made and jointed, and, indeed, may be perfectly gas-tight to commence with; but unless the pipe is laid on a solid bed, the permanency of the work cannot be ensured. Although this seems a simple matter, experience has taught me that too much attention cannot be given to it.

The question is sometimes asked, "Ought our gas mains to be coated?" I think they ought, both to hinder corrosion and to reduce friction. The cost is not great, and the result must be beneficial. A very cheap mixture, and one very suitable for the purpose, I have found to be: To 100 gallons of boiled tar add 7 lbs. of gutta percha and 7 lbs. of rosin. Dissolve the gutta percha and rosin in naphtha; then mix with the tar (all hot, of course), thin the mixture with crude naphtha to the proper consistency, and it will be found a durable and efficient varnish. If green tar is used, the naphtha will be found unnecessary.

In concluding my notes on main pipes, I would say, have them all of ample capacity. This is an old story, but it is one that comes with special force in these days when gas engines are becoming so generally adopted. With small mains, and these probably pretty nearly taxed to their utmost capacity, the inconvenience to ordinary consumers in the neighborhood of a gas engine, by the oscillation of the gas lights, is very great. A large main serves as a reservoir from which the gas engine can be supplied without inconvenience to any one.

I suppose it will not be considered very far out of place in such a paper as this, to say a few words on service pipes. The two systems of piping—mains and services—are so closely allied that they may, indeed, be classed as one; and conditions stipulated in regard to mains are, as a rule, equally applicable to services. How, then, are services to be connected to the mains? Are they to be screwed into the latter, or connected by saddles and straps? The latter method is, in my opinion, by far the best; it allows for deflection of the main, is easily connected, and can be as easily removed. I have no faith in any screw made in cast iron. The nature of the material is such that a screw, made never so carefully, can scarcely be complete, and consequently will not be satisfactory. One very great objection to screwed services is the fact that they have to be connected so often in bad weather, and under most unfavorable conditions, that the work is hurried over and buried as rapidly as possible, so that the imperfections may be completely hidden from the searching examination of the superior officer, who, perhaps, can only visit his pipe layers at wide intervals. I have seen, on more than one occasion, when a service pipe was being connected to the main, that the thread of the screw would give way, or, technically, would be "stripped;" and, rather than tap the whole afresh, the loose joint would be made gas-tight by some temporary means, which would, of course, give only temporary satisfaction. Where the service pipe is large—say, 3 inches—I think proper branches should be employed, so that the main pipe will not be unnecessarily weakened by the operations.

Speaking of service pipes, I think we, as a rule, employ far too light tubes. The weights generally adopted are, I believe, as follows:

Size....	⅜	½	¾	1	1¼	1½	2	2½	3
Weight,	0.584	0.809	1.165	1.714	2.497	3.032	4.175	6.087	7.221

The size is given in inches and fractions; the weights in pounds and decimals per foot.

The weights I employ, and which are specially made for me, are as follows:

Size....	⅜	½	¾	1	1¼	1½	2	2½	3
Weight,	0.800	1.00	1.500	2.25	3.20	3.75	5.00	7.00	8.75

The reason why these weights have been adopted (and it was the result of long experience) was the fact that in many cases the tubes have to be bent to certain angles, and this while in the cold state; and the ordinary or thin tubes, especially if made by an ordinary firm, would not withstand the strain. The heavier tubes having more substance, and the molecules forming such being more firmly knit together, the process of bending can be accomplished without risk. Then the life of the service pipe is so extended by these heavy tubes that, even in this respect alone, they are desirable.

On no account would I lay a malleable iron service pipe without its being properly coated. As you are all doubtless aware, malleable iron is a ready prey to oxidation; and this, in certain soils, proceeds with great rapidity. To check this destructive process, I give all malleable iron tubes, when they arrive from the makers, two coats of the best red lead. This I find answers the purpose well—preventing for a long period any attack from this very formidable enemy to service pipes.

The material in which the service pipes are laid should also be carefully observed. If the soil contains anything like ashes, such should be removed, and a more inoffensive material put in its place. I knew of a case where a service pipe was laid in boiler ashes, and in less than one year the consumer complained (as well he might) of a want of light. The ground was opened, and search was made for the defaulting service pipe, but without success. The pipe was thoroughly oxidized, and had made complete and fast friends with the material surrounding it; and this so effectually, that the one could not be distinguished from the other.

In regard to large service pipes for supplying mills, factories and other large works, I think many of us have fallen into error by placing meters in every department of the works, and carrying the service pipe to each. I entirely object to the system of laying any pipe containing unmeasured gas within the gates of any public works. In the first place, the meters and pipes are, to a certain extent, beyond the gas people's control: and in the second place, should a fire occur, the difficulty and danger of removing the meter or meters in danger of destruction is great indeed. The principle I adopt, as far as possible, is to place a large meter in or near the lodge at the gate; and to this the service pipe is connected. Then the consumer can carry the pipe through all the ramifications of his works, and, indeed, wherever he pleases.

In some towns, the practice of laying lead service pipes is adopted. I am not in a position to speak as to the advisability or otherwise of the system; but I am hopeful that those present whose experience in this direction warrants them will give us the benefit thereof.

And now, gentlemen, my story is about told. You will have observed that I have spoken a great deal and said very little. But, after the explanation I gave at the outset, it is quite unnecessary to apologize further; and I have only now to thank you for the patient hearing you have afforded me.

Discussion.

The Chairman remarked that the members had listened to an exceedingly interesting and valuable paper; and he asked for remarks or questioning upon it.

Mr. T. Whimster (Perth) described the paper as a practical one, and agreed that the means proposed for avoiding the crushing of pipes by heavy steam vehicles was perhaps the best. There was, he said, great temptation, no doubt, where there was a stretch of level ground, to come nearer the surface with a main pipe, so as to escape drips, and the necessary labor and expense of keeping them empty. He thought it a good plan never to come nearer the surface than 30 inches. Although it might be expensive, he would rather go 6 feet down than come above, because it not only exposed the main pipes but the service pipes also. He had lately had some experience of this. Heavy steam vehicles were of recent introduction, and some of the mains in Perth had previously been laid near the surface. Quite recently a heavy roller was sent along a street in which they could not go down very deep on account of rock, and the main had been laid within 12 inches of the surface. This main was broken in three places. Where they could get down, it had been his rule, for many years, to go as deep as Mr. M'Crae had mentioned. In many cases he had gone down 6 or 7 feet to escape drips; indeed, in the last case he went down 7½ feet. In laying malleable iron service pipes, he attached the pipe to the main with a malleable iron clip. In some instances he had used between the clip and the main a small saddle, hollowed on one side to make it sit on the main. Where iron service pipes were laid, they put tar round the junction, and covered it with a piece of wood. He found that every care taken to escape damage to pipes by surface disturbance was a sure means of preventing leakage, and ultimately paid itself well. His long experience had confirmed him in these means for preventing leakage.

Mr. A. Bell (Edinburgh) asked if he understood that Mr. M'Crae coated pipes inside as well as out.

Mr. M'Crae said he did.

Mr. Bell feared there would be a lack of illuminating power if thick tar were reduced with naphtha. He said he never, as a rule, coated the inside of a cast iron pipe. Gas was pretty dry, and there was very little oxidation from it.

Mr. A. Smith (Aberdeen) agreed with both Mr. M'Crae and Mr. Whimster that pipes ought to be so laid as to have a cover of at least 30 inches, because traction engines were a great source of annoyance. He looked upon the connection of service pipes by means of a saddle as the best way of doing this. With regard to the coating of pipes, he mentioned that on one occasion when, to oblige a contractor, they took a

number of coated pipes and laid them; by the end of six months the whole of the coating had worn off. After this he coated a pipe experimentally to ascertain what was the fact; and he found that every particle of the coating came off. There might be a difference in the coating material; his was an ordinary coating for water pipes. Perhaps Mr. M'Crae might be able to give them some explanation of it.

Mr. J. Hall (St. Andrews) remarked that Mr. M'Crae had not made a single statement that he could not fully bear out. All the pipes he himself had laid for a good number of years he had coated, and he had never found the least disadvantage from it. He thought the coating very materially reduced friction. He was of opinion that all pipes should be coated.

Mr. W. Mackenzie (Dunfermline) said he at one time laid a 2-inch service pipe which had been coated very thickly inside with tolerably well-boiled tar. The pipe had not very much declivity, but in a very short time it was obstructed, and he found that the tar had closed it up altogether.

Mr. A. MacPherson (Kirkcaldy) had listened with very great pleasure to Mr. M'Crae's paper. The quality of the iron should, he considered, form a very important factor in connection with the purchase of pipes. They occasionally had pipes made of stuff that was very inferior—sometimes altogether unworkable. The character of the soil in which the pipes were to be laid was also a matter to be very carefully studied. He was sure it would pay any engineer, in laying pipes where he had bad soil, to remove a portion of it, even at considerable expense, and to cart proper soil. He agreed with Mr. Mackenzie and others that the internal coating of pipes very soon dissolved. He could not see that friction was in any way helped by internal coating, because, this being very speedily removed, the friction remained as it was. Mr. McCrae spoke of leakage. They all knew it to be their duty to see that all pipes were carefully and accurately laid; but he thought a more important factor in the unaccounted-for gas would be found in the temperature. Some managers reduced the temperature so much that they under-measured their gas, whereas if they kept the temperature high, not only did they preserve their illuminating power, as Mr. Hislop had told them, but also considerably reduced the value of their tar; clearly showing that they were adding to the value of the product which they primarily wanted—viz., gas. They were not supposed to make tar, but gas; and they would find that gas at a temperature of 60° or even 70° had a greater illuminating power per ton of coal than gas of very much lower temperature, and that, although the apparent leakage might be greatly in excess, there was a very considerable saving in not reducing the temperature too low.

Mr. D. M. Nelson (Glasgow) said he found in some small towns a very excellent arrangement for coating pipes after they had been laid. In his opinion there was a good premium awaiting the man who could contrive a method of dipping pipes which would not coat them inside. He thought, however, that coating a pipe inside was not of much consequence, because there was little or no deterioration inside a pipe.

Mr. J. McGilchrist (Dumbarton) thought Mr. McCrae had only made one mistake. If he would take the tar he used inside and apply it to the outside of the pipes he had no doubt it would result in great benefit.

Mr. W. Key (Tradeston, Glasgow) said there was no doubt whatever that Mr. McCrae deserved well of the Association for bringing forward this subject. The way in which the paper had been received showed how a matter of not very great importance (laughter) could elicit a good discussion. The substance of the paper might be summed up in the words, "Beware of the Steam Roller." They ought to see to it that the pipes had a covering of at least 2 feet 6 inches. The steam roller, he thought, ought to be looked upon as an established institution, and they must lay their mains as suggested by Mr. McCrae, very much towards the curb, so as to avoid the heavy traffic and the heavy pressure from the road. In doing this in a town considerable difficulty was sometimes encountered, because they came into contact with the sewer connections with the houses. He found this some 15 years ago in Dumbarton where they had nine traps in a mile—all occasioned by going under or over connections with sewers. To escape this he went down some 6 or 7 feet, and to avoid the sewer connections he laid the main close to the curb. By this means he also avoided the opening of the street. As to coating pipes, he did not think it a very serious matter. There was, of course, the result mentioned by Mr. Smith, which was the effect of the contact of the hydrocarbons in the gas with the tar at a low temperature. The same thing took place in the condensers all the year round; and the result was to reduce the illuminating power of the gas. This proved the necessity for keeping up the temperature in the apparatus, so as to prevent deterioration by contact with tarry surfaces. It had been advocated from the chair of the Association that the temperature of the gas should be reduced to that of the air for the time being. This was quite a mistake; and, of course, it explained to a great extent why in some years Mr. McCrae found his leakage to be low, and could not assign any special credit to himself for its being so, while another year it was high, and he could not take blame for such a condition of things. In some years they had a very extensive period of frost: and although the gas might be registered in the house at 60° F., yet, after passing through long mains, there was no doubt that the gas would be registered at the consumer's meter at a much lower temperature than that at which it left the works. In another year the weather might be very mild; and then this result would not occur. He would suggest that the men who attended to the drips should be instructed to take temperatures not only during the day but at night, when the supply was going on. By ascertaining the temperature of the street mains the engineer would be better able to ascertain what was the cause of leakage.

Mr. T. D. Hall (Montrose) remarked that there was only one point in the paper he wished to take up, and that was the depth at which mains should be laid. Not only were they safe from steam rollers when laid deep, but a better connection with the houses was possible, because the men were able to connect them on the top, which was a great advantage in that it prevented the screw being broken. Mr. Nelson's plan of coating the main after laying was a very good one He had seen a plan of filling up the ground very nearly to the top of the main, and then pouring in green tar, which formed a sort of natural asphalt.

Mr. D. Bruce Peebles (Edinburgh) asked whether pulsators did not thoroughly prevent the disagreeable fluctuations which Mr. M'Crae had stated were experienced by consumers in neighborhoods where gas engines were used.

Mr. Key said that he should like to answer that question. He saw some years ago, in the Carlisle gas works, the effect of a gas engine at the railway station, which was quite close to the gas works. He thought the main supplying the district was a 15-inch one, and the governor was oscillating something like 6 or 8 inches with every stroke of the engine, whereas the gauge (which was one of King's, divided into hundredths of an inch) did not vary more than one or two hundredths. His attention was drawn to this by Mr. Hepworth, the Engineer; and he (Mr. Key) was very much intererested in it, because it showed him that a pulsator would do the work this governor was doing. The governor was different from most of those in use. It had not a bottom that would receive a stroke from the pulsator; and the consequence was that the crown acted as a pulsator, and went up and down a good deal, while the pressure in the main varied only a little.

The President said he was exceedingly pleased that the paper had elicited so extended a discussion. He agreed with Mr. M'Crae's remarks at the outset, with regard to the length of papers generally, and the importance of a much larger number of members submitting them, although they might not necessarily be of very great length. If they were only suggestive, then the discussion following might be very important and valuable. With regard to main pipes, he fancied it would be a rather difficult matter to insure, in every case, that a certain kind of metal was used, because it would be very difficult to watch the casting of every pipe in the foundry, although in some cases regulations were laid down controlling the contractor. Coating, no doubt, was a good thing; but, at all events, they only looked at the outside coating as being of any avail. It was certainly a well-known fact that in a short time the whole of the inside coating was removed by the action of the gas; but it was also well known that they could not coat the outside without coating the inside. He had asked pipe manufacturers if this could be done, but they said it could not. If they painted a gasholder on the inside they would find, in a short time, that the paint all came off, like a sheet of paper. It could not resist the action of the gas. If it were possible to cast on end pipes of the smallest size, it would be a good thing; but this could not be done. The idea of laying pipes a good depth below the surface was certainly a good one. The practice was common in cold climates, such as Russia, where the pipes were in no case less than 5 feet in the ground. He had for many years adopted the practice of laying all main pipes in the footpaths, and connecting the services with faucets and nipples. This secured a sure service, thereby reducing leakage to a certain extent. When they got out of difficulty with vehicular traffic, the leakage was sure to be reduced. In every case he laid a main on both sides of a street. This, in his opinion, overcame the difficulty of damage by traffic; and reduced the cost of service pipes and the amount of leakage. In many cases, however, it was necessary to lay pipes in the main street, and then the wisest course was to keep them down to the depth suggested. On the whole, he thought they were exceedingly indebted to Mr. M'Crae for his paper, and he was sure that they had all benefited by the discussion to which it had given rise.

Mr. M'Crae thanked the speakers for their very kind criticism of his paper; indeed, he thought the criticism was better than the paper itself. With regard to Mr. Bell's remarks as to the reduction of illuminating power, he might say he had not had any experience of it. Within the last month he opened a gasholder which had been built for 30 years, and the riveter's marks were still on the inside—the actual white paint. This was his experience; but it was just in a meeting like the present that their varied experiences came to light. He thought that Mr. MacPherson was quite right about temperature, and it would be remembered that, at the informal meeting of gas managers held in Glasgow last April, he pointed out the importance of the temperature at which gas was measured, especially in the winter time. It cut in a double direction. In the winter time they were making so much more gas that the temperature was always higher; but he did not refer to it that day because he thought it really had no bearing upon main laying. In Dundee he believed there were between 50 and 60 gas engines, and he found that pulsators were looked upon as very objectionable. Manufacturers did not object to paying £100 for a gas engine, but they begrudged £2 more for a pulsator. In Dundee they were not bound to supply gas for gas engines, and when they did so they furnished it *ez gratia*. They were only bound to supply gas for illuminating purposes, and had several times refused gas for use in engines. When they did this the manufacturer fell back upon the pulsator, and every time one had been used it had been very satisfactory.

Mr. Peebles said the observations just made by Mr. M'Crae suggested matter of very great importance. To paint a gasholder with white paint was a different thing altogether from coating it with tar.

Mr. Stewart (Greenock) said he could bear out the President in this matter.

Mr. MacPherson remarked that it could easily be tested.

Mr. Peebles stated that gasholder sheets which were thoroughly eaten through with rust had been found to be perfect where the marks of the makers had been written on the inside with a paint consisting of a very slight admixture of white lead and turpentine. This suggested to him that there might be some sort of chemical action. He thought this was a point for gasholder makers to thoroughly investigate.

Varieties of Clay, and their Distinguishing Qualities for Making Good Puddle.

[Abstracted from a paper by Wm. Gallon, M. Inst. C. E.]

Geologists agree in ascribing the origin of clays to the decomposition and disintegration of the feldspars in granite, gneiss, mica slate, and clay slate, by atmospheric erosion and trituration in water. The argillaceous rocks, from which clays are principally derived, are distinguished by a peculiar earthy odor, emitted by them when breathed upon. Clay beds are due to the deposition of water-borne materials at the bottom of estuaries, lakes or seas; and boulder clay is ascribed to glacier action. Any substance formed of minute particles of decomposed earthy material, which, when worked up with water, becomes plastic or capable of being moulded, is commonly called clay. No natural deposit of absolutely pure clay has been found; but the residue, after washing out all the impurities from clay, is a hydrated silicate of alumina, which is the plastic, and consequently the most important constituent of clay, insoluble in water, and incapable of supporting vegetable life. Water combined with the silicate of alumina gives it its plasticity. Part of this water is merely absorbed into the pores of the clay, and can be driven off by exposing the material to about 212° Fahr.; but the remainder, which is in combination with the clay, can only be removed by a prolonged high temperature, as in baking bricks, depriving the material of its plasticity, and causing it to shrink in proportion to the bulk of water expelled. Some analyses of different kinds of clay gave from 46 to 66 per cent. of silica, 22 to 38 per cent. of alumina, from 5 to 13 per cent. of water, small variable quantities of oxide of iron and lime, and traces of magnesia.

The purest form of clay, containing the largest proportion of alumina, is known as kaolin, the name of a mountain in China, where a pure white clay is worked, described as a pure chalk-white, dull earthy, unctuous substance. The kaolin found in Devonshire and Cornwall is called Cornish, or sometimes China clay. Teignmouth clay, so called from being shipped at Teignmouth, is as free from quartz as washed kaolin, and is believed to be the sediment washed down from Dartmoor, which was deposited in a fresh-water lake. Some clays are designated by the principal use to which they are applied, namely, china clay, potter's clay, pipe clay, and fire clay. The main difference between china clay and pipe clay consists in the proportion of silica in their composition. Pipe clay shrinks too much in heating to be available for making pottery. Potter's clay includes a variety of clays containing considerable quantities of impurities. Fire clay resists fusion owing to the large proportion of silica it contains; thus Stourbridge fire clay contains 65 per cent. of silica, or nearly 20 per cent. more than pure kaolin. Clays are also designated by their color, as red, blue, brown, yellow or ochrey, and variegated clay. The coloring matters consist mainly of metallic oxides, notably oxide of iron; organic substances also affect the color. A red color in clay in its natural state indicates the presence of peroxide of iron. A yellowish or brown color denotes the presence of hydrated peroxide of iron in the clay, which becoming anhydrous on burning imparts a red color to the clay. The Dorset and Devonshire clays, being free from iron, are white when burnt, which renders them especially valuable for pottery. Clays containing manifest impurities to a considerable extent are designated by the terms shaly clay, sandy clay, loamy clay, and marly clay. Any soft admixture of clay and lime is termed a marl—clay marl when the clay is in excess, and marl clay when the lime predominates. Many clays are known by the name of the neighborhood from which they are obtained, such as London clay, Oxford clay, Grinstead clay, Wadhurst clay, Weald clay, Kimmeridge clay, Gault clay, Poole clay, and others.

Puddle is of considerable importance in engineering works for arresting the passage of water. Some clays, such as the London, Kimmeridge, and Oxford beds, are practically impervious to water in their natural conditions; whilst others offer more or less resistance to its passage in proportion to the absence of impurities. Springs at faults or at the outcrop of clay beds furnish evidence of the impermeability of these beds. Most clays, when free from coarse, gritty impurities, contain sufficient alumina to become practically impervious to water when worked up into puddle. When puddle is protected from evaporation, as is generally the case, the admixture of impurities has the disadvantage of diminishing its cohesiveness, and consequently its impermeability. If, however, puddle is placed so near the surface as to be liable to lose its moisture by evaporation or capillary attraction during dry weather, the addition of sand may be necessary to prevent the contraction of the mass, and the consequent formation of fissures such as occur in clay soils in times of drought. The sand, by diminishing the cohesiveness of the clay, obviates the rupture produced by the contraction of a tenacious mass; and with this object the brickmaker adds sand to clays deficient in silica to prevent his bricks cracking when being burnt, and the potter incorporates ground flint with his clay to reduce the amount of contraction.

The general suitability of most kinds of clay for puddle has caused an absence of precision in the definition of the requirements for puddle in specifications. The essential condition for puddle is that it must be impervious to water; and no special purity in the clay is required to attain this result. Tempering the clay by working it up with water, so that its original formation is broken up and a new arrangement of particles formed, with additional water to fill up every pore, is the important requisite for the formation of good puddle. It is peculiar that puddle, though formed to exclude water, should require water for its manufacture. Tempering clay for forming puddle is greatly facilitated by exposing the material to the atmosphere, especially in winter, when rain, snow, frost and changes of temperature disintegrate the clay more thoroughly than even grinding it in a pug mill; and the labor of working it into puddle by cutting, cross-cutting, poaching it with a tool, or treading, is materially reduced. Clays well suited for puddle are opaque and not crystallized; they exhibit a dull, earthy fracture, exhale, when breathed upon, a peculiar faint smell termed argillaceous, are unctuous to the touch, free from all gritty matter, and form a plastic paste with water.

The important properties of clay for making good puddle are its tenacity or cohesion, and its power of retaining water, which really coexist, but are separated to facilitate description. The tenacity of a clay may be tested by working up a small quantity with water into a thoroughly plastic condition, and forming it by hand into a roll about 1 to 1½ inches in diameter by 10 to 12 inches in length. If such a roll is sufficiently cohesive not to break on being suspended by one end when wet, the tenacity of the material is ample. To test its power of retaining water, one or two cubic yards of the clay should be worked with water, by the usual methods, to a compact homogeneous plastic condition; and then a hollow should be formed in the center of the mass capable of holding four or five gallons of water. After filling the hollow with water, it should be covered over to prevent evaporation, and left for about twenty-four hours, when its capability of retaining water would indicate its suitability or unsuitability for making puddle.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, August 10th, 1889.

The Gas Light and Coke Company.—The Truth about Water Gas.—Labor in Gas Works.

The report of the Directors of the Gas Light and Coke Company of London, as just issued to the shareholders, for the half year ended 30th June last, is for several reasons a document of more than usual interest. Attention has lately been directed, from more than one quarter, to the doings of gas companies, and it has suited the purposes of certain persons to misrepresent the same. Whether done in ignorance or otherwise, the misrepresentation has been none the less real. Gas consumers have been warned that coal gas is poisonous, dirty, impure, unnecessarily costly, etc., and that the only hope for health, coupled with efficient artificial lighting, is—water gas, oil, electricity, or other things, according to the status of the party originating the statements. The "horny-handed son of toil" has been informed that the gas companies are labor tyrants, grinding out large profits with the aid of long hours of arduous labor, coupled with insufficient pay. Under these circumstances the Directors have done wisely in entering with greater detail than usual into various circumstances connected with the gigantic undertaking they control. Their plain and unpretentious statement of facts cannot but carry weight with all who really desire to get at the truth, and have too much sense to be caught by the rabid utterances of professional agitators and Sunday morning platform spouters. They commence by giving several details as to increase in their operations since 1883. The annual consumption of coal has risen from 1¼ to 1¾ millions of tons, and the make of gas from 15,000 to nearly 19,000 millions cubic feet. The maximum day's consumption has risen from 95 to over 105 millions cubic feet, representing a carbonization of over 10,000 tons of coal. These facts may be commended to the attention of those who fondly imagine that they can successfully compete with coal gas, or who indulge in poetical but misguided fancies such as "coal gas has now reached its zenith and begun to go down the hill." In the face of the above facts this sort of thing cannot be expected to "go down" with the public. The number of consumers has increased from 185,000 to 206,000, the public lamps in about similar proportion, and the length of main from 1,700 to 1,850 miles. That the Directors have not been unmindful of their duty towards the consumers is shown by the fact that the price of gas has been reduced from 76 to 60 cents—a reduction of more than one-fifth. And yet there are some who complain that there is no such thing as progress in the gas industry. It seems to me that the state of affairs as above indicated shows something very much like progress and that of the right sort.

The Directors proceed to deal with their relations in regard to the workmen under their employ. On this subject they are able to take up a bold stand, having always treated their workmen liberally and cared for their welfare in every way. Sick and provident funds, promoted and subscribed to by the Directors, but managed by the men themselves, have been in existence for many years. The evidence afforded by the books of these societies, as recorded by the representatives of the men, effectually disposes of the assertions so freely made of late, that the stokers and other retort house men are worked in such a manner as to be positively injurious to their health or comfort. Out of over 6,000 members the daily average number on the sick list has been 153, or only 2.5 per cent.; and there have been 27 deaths, less than 9 per 1,000 per annum. The number of persons injured during the half year by accident in connection with the gas supply was only 19; and this number, small as it is, includes not only the companies' servants but the public generally, and anyone who has suffered by any accident traceable to the operations of the Company. Every efficient permanent workman receives a week's holiday in each year without loss of pay; and there is a system of pensions open to those who have served the Company for a certain period. Further than this, the Directors are able to attend to the erection of cottages, with a church and schools, for the use of the men employed at Beckton. Reference is also made to the introduction of 8-hour shifts in the retort houses in place of the 12-hour system, to which subject I propose to refer in a separate paragraph. The cessation of the London coal dues, by which the Company will be relieved of a tax of 26 cents per ton of coal, the disturbed state of the coal market, water gas, the recent legislation in respect to electric lighting, and other matters, are also noticed in the report.

In view of the attention lately directed to water gas, which has so far been principally confined to financial circles, a little pamphlet entitled "Water Gas, its Chemistry, History, and Prospects," which has just been issued, is attracting some attention. It consists of a reprint of a series of articles that have appeared in the *Iron and Coal Trades Review*, and is published at the office of that periodical. The author's name does not appear, but will scarcely fail to suggest itself to those accustomed to move in gas engineering circles; for the number of writers who combine a thorough acquaintance with the history and theory of the subject, with a classical education and a sufficient degree of literary skill to represent such a dry ("dry" is of course used metaphorically and not literally) subject as that of water gas in the form of attractive reading for the general public, is extremely limited.

With the chemical and historical part of the subject most gas engineers are already fairly well acquainted. But they will be interested in following the sound and ingenious reasoning by which the writer shows that, whether for lighting or heating, water gas is more costly, apart from other objections, than coal gas at modern prices in England. Amongst several other conclusions, he states that as an illuminating agent water gas can be most economically used when carbureted. In this form it is dearer than ordinary coal gas, and much dearer than coal gas used with regenerator or albo-carbon burners. As to lighting by incandescence, there is as yet no really durable burner on the market. As a means of distributing power, water gas cannot successfully compete with coal gas or electricity. Writing on the financial side of the question, in regard to the action taken by patentees in selling their specifications at high prices, he recommends capitalists to be very chary in paying high prices for mere abstract ideas, or for calculated future profits. He would not object to the inventor receiving an immediate consideration equivalent in value to the expenses incurred in perfecting the invention, but considers that inventors should be satisfied to look for future remuneration to the actual profits earned by the invention. It must be admitted that the particulars of actual operations carried on with water gas patents afford ample evidence in support of this opinion. Perhaps I should observe that the conclusions above mentioned refer to England only, where good gas coal is to be obtained at prices little more than half that of anthracite, and the price of petroleum, even close to the chief shipping ports, would not be less than 8 cents per gallon at wholesale rates. Of course, in other parts of the world it may happen that bituminous coal is more costly than anthracite, and that petroleum is obtainable at less than 2 cents per gallon.

For some time past there has been a little dissatisfaction amongst gas stokers in London. The cause of it is not far to seek. The introduction of generator firing has led to the use of a greater number of retorts in each setting, of heavier charges in each retort, and, in some cases, of shorter periods between each charge. The effect of this has been to increase to some extent the labors of the retort house employees. Among other grievances the men considered that 12 hours work per day was too long, and decided to have the 8 hour system, or three shifts in the 24 hours instead of two. Of course, it is well known that what is termed the 12 hour shift does not represent 12 hours of work. The men are really only engaged for half that time, and often less, in the retort house, the remainder being open for rest, meals, ablutions, etc. Further than this, as a matter of fact the so-called 12 hour system is in many works not more than 11 to 11½ hours. Looking fairly at the case, no one will blame the men for being willing to work rather harder during a shorter period, in order to secure a few hours of leisure in which they can don clean and dry clothing, leave the smoke and dust of the retort house behind them, and enjoy the society of their families.

Possibly very little would have been heard of the matter outside the gas works walls, had not this state of affairs come to the knowledge of certain public agitators who pose as the only true friend of the workingman, but who might more appropriately style themselves the enemy of the capitalist, seeing that their writings and speeches are more directed to abusing the rich than to assisting the poor. Some of these individuals have been preaching the doctrine of eight hour labor per day for years, and of course the gas stokers afforded a convenient tool for the furtherance of their views. It was no secret that some of those who are high in authority in London gas matters, were not unfriendly to the eight hour movement, and therefore a good opportunity was afforded for a little cheap and easily earned notoriety. An attempt was made to give the usual trade union characteristics to the movement, but was quite unnecessary, as the matter has been settled in a friendly manner, by conferences between the Directors and the representatives of the men.

The Directors of the Gas Light and Coke Company, in their report above referred to, state that the men contended that 12 hours at a stretch of retort house duty, carried on under great heat, was of an exhausting nature, and moreover left no time for devotion to their families or for self-improvement. The Directors feel there is some ground for supposing that the eight hour system would be better for the men, though necessarily more expensive, and have therefore consented to introduce it.

The other London gas companies have adopted the same course, and the result will lead to the employment of a greater number of men. Each man will not do so much work in eight hours as he formerly did in twelve, but at the same time he will do a larger quantity per hour. It was pointed out that a simple shortening of hours of labor, with no other change, would mean an increase of 50 per cent. in wages, which was not reasonable. Of course circumstances vary at different works, and it is impossible to lay down a general rule for all. But speaking roughly, it appears that each man is to do, under the new arrangements, about five-sixths as much work as he formerly did in twelve hours. The additional cost to the gas companies will therefore be about one-fifth of the amount at present paid as wages. This is a large item, and it is only natural that the Directors should refer to improved charging and drawing machinery, at present being fitted up, and hold out some prospect of extending this system from time to time.

[Concluded from page 242.]

Concrete Floors.

By Frank Caws, in London *Builder*.

As before noted, the behavior of glass window panes very well illustrates the behavior of cement concrete. The behavior of cast iron is likewise very similar to that of concrete. The reason for this similarity appears to lie in the fact that the compressional strength of each of the three materials is largely in excess of the tensional strength; being, for cast iron, about 7 to 1, for neat cement about 10 to 1, and for glass about 11 to 1. For cement concrete the proportion of compressional to tensional strength will vary according to the nature and relative quantity of the aggregate. The concrete for floors, mixed as before described, is a much tougher or softer material than pure cement, and immensely tougher or softer than glass; that is to say, much less brittle, softer, and more flexible. Probably the compressive strength of such concrete is about 8 times its tensile strength, as remarked in Part 1. The principle appears to be universal that, all other things being equal, the most flexible materials are those whose compressive strength most exceeds their tensile strength, and the most flexible materials are those whose tensile strength most exceeds their compressive strength. Thus glass, with 11 of compressive to 1 of tensile strength, is very much more brittle than cement concrete, with 8 of compressive to 1 of tensile strength; though the actual strength of glass is about 20 times that of cement concrete in tension. The marvelous difference between the toughness or softness of the concrete and of the glass is shown by the fact that concrete can be cut with a chisel, while glass can only be cut by a diamond.

But, notwithstanding the great difference between the flexibility of cement concrete and of glass, as already suggested, the likeness between the behavior of window panes and of concrete floor slabs affords a valuable index to the real strength of the latter. No practical builder would hesitate to put in window panes 1 ft. square of ordinary sheet glass $\frac{1}{16}$ in. thick (*i. e.*, 21 oz. per super. foot) to withstand the heaviest wind pressure—of, say, 84 lbs. per ft.; nor would he hesitate probably to make the same pane of glass serve as the floor of a parlor aquarium to sustain 16 in. of depth of sea-water—*i. e.*, about 84 lbs. per ft. load. We know that shop windows of plate glass from 8 ft. to 12 ft. square by not exceeding $\frac{1}{4}$ in. thick (and generally of less thickness), safely sustain, as a rule, the pressure of the heaviest storms of wind encountered in the streets, reaching an occasional maximum, probably, of about 42 lbs. per ft. [Of course, it may be said the glass has not, when so set on edge, to bear the leverage of its own weight, as it would have to do if laid flat. But its own weight would only represent a very small fraction of the total load, when 84 lbs. per ft. wind pressure was at work—about $3\frac{1}{2}$ per cent., in fact.] And when, as rarely happens, shop windows are blown in, the weakness proves oftener to lie in the imperfect bedding and fixing than in the glass itself. The tensile strength of sheet glass of good ordinary quality is about five times that of matured neat cement, and about twenty times that of matured cement concrete, mixed one of best Portland cement to four of good, hard, well-burnt brick aggregate.

The strength of slabs is inverse to their breadth or diameter, and is as the square of their thickness.

If the glass pane, 1 ft. square by $\frac{1}{16}$ in. thick, had possessed only $\frac{1}{256}$ of its strength we should set it to carry a pressure, not of 84 lbs., but of $\frac{84}{256}$, equal, say, 4 lbs. per ft. And if it were 1 in. thick it would carry 100 times as much, because 10^2 equal 100.

Thus we may theoretically adopt as a unit base of calculation for the strength of concrete slabs (subject to an ample allowance for practical contingencies) a slab 1 ft. square by 1 in. thick, carrying 400 lbs. safely, equally distributed, all the four edges of slab being well bedded on an unyielding foundation.

If now we make the slab ten times as large, while keeping it still 1 in. thick, we shall have a slab of 10 ft. square by 1 in. thick sustaining a safe load of 40 lbs. per ft. If we increase the thickness from 1 in. to 4 in. we shall increase the strength sixteenfold, thus making the safe load 640 lbs. per ft.

Thus we ascertain that a slab of concrete of matured strength, mixed in proportions 4 to 1, as before described, if about $171\frac{1}{2}$ ft. square by 6 in. thick, will sustain an equally distributed load of 84 lbs. per square ft., including its own weight of, say, 60 lbs. per square ft. as safely as a 21 oz. window pane, 1 ft. square, will sustain a hurricane pressure of 84 lbs. per ft.

Constructionists who refuse to believe concrete floor slabs of vast size are capable of carrying their own weight and heavy loads, overlook the fact that glass slabs, so to speak, in shop windows are commonly found exhibiting a degree of strength much more remarkable than that of a concrete slab $171\frac{1}{2}$ ft. square by 6 in. thick.

The enormous difference between the resistance to flexure of a slab bedded on all its edges and a beam bedded only on its two ends, though of the utmost practical importance, appears to have escaped the notice of writers and compilers of constructional literature.

In proof of the enormous difference referred to, the following very homely experiment will suffice.

Take any rectangular picture on a card-board mount—say, for example, an ordinary *carte-de-visite*, out of its frame; and, having first removed the glass, place the frame, face downwards, flat upon the table, and lay across the narrower way of the frame the *carte*, letting its two ends rest on the frame, thus constituting the *carte* a *beam*, *pro tem.* Now place a threepennybit on the middle of card, and upon that a sixpence, then a shilling, and then a pile of coppers, building up the latter slowly and carefully till the cardboard beam has deflected so far as just to touch the table in the middle of span. Now relieve the *carte* of weights, and, if it be fairly elastic, it will return to its normal flatness. Now replace the card on the rebate of the frame, so that all its four edges are fairly bedded thereon, and repeat the experiment with the coins. The *carte* is no longer a *beam*, it is a slab now, and the heap of coins which caused the beam to deflect till touching surface of table, produce scarcely any visible effect on the slab. An enormous increase of load is necessary to cause the slab to yield to nearly such an extent as the beam; and when, under this vastly multiplied load, the slab eventually gives way, it is awkwardly creased or crinkled and crippled, in a totally different manner from the beam flexure, and its elasticity will not restore the slab to flatness, when once it has been so crippled and crinkled. It will be found that at least sixteen times the load is needed to produce the same deflection of slab as of beam. Again, as a final experiment, if the card, without being crippled or bent beyond its elastic power of recovery, is not only allowed to rest on its four edges, but is also pinned, or gummed, or otherwise well fastened down to those edges (*encastre*, in fact), then the experimenter will find a very considerable further increase of resistance to flexure has been thus obtained; probably, in most cases, about 50 per cent. additional stiffness to that of the slab at first described.

The laws of stress and strain pay as much respect to, and are as much respected by, the humble *carte de visite*, as to and by the mammoth bridges and roofs of the most ambitious engineering; and the wise student will learn no less from the common than from the rare examples accessible to his investigation.

The more deeply acquainted the constructor becomes with the nature of cement concrete, and with the manner of stress and strain to which it is liable, the more strongly will he be convinced that it is neither the dead load nor the rolling load; but the force of expansion initially, and (in exceptional cases only) the force of impact eventually, which he has special need to consider and guard against.

We have already seen that the force of expansion cannot only be prevented from injuring the slab, but can be utilized in compressing and increasing the density and strength of the slab, simply by securing inflexible centering, and also by keeping that centering at least five weeks, and as much longer as practicable, in position after the slab is cast. We have also seen that the injurious momentum of mass, induced by sudden removal of centering, can be obviated by using wedges, and slowly relieving the centering of pressure.

But, when all has thus been done that can be done to obtain a slab free from expansion, cracks or flaws, another enemy to the endurance of the floor *may* (?) have to be confronted in the shape of impact.

A rolling load (if not jerkily rolling) is not impactive, but is simply equivalent, in its effect on the floor, to twice the force of the same load

statically applied. The force of an impactive load is governed, not only by the weight of the falling body and by its velocity, but also by the degree of yielding of the two surfaces brought into contact.

A universal law, for which no better name can be found than the *Acceleration of Elasticity*, decrees the exact duration of yield of every elastic body under dynamic stress. This duration is determined by the measure of deflection due to the weight in question, acting statically on the body in question. For example, let it be supposed that a weight of say, 10 tons, resting on the middle of a concrete slab, has caused a static deflection of say, $\frac{1}{4}$ in., from which, say, the slab will fully recover if that 10 tons weight be taken off.

If, now, instead of applying the 10 tons statically, we place it on the slab, and suddenly allow the slab to assume the pressure; that is to say, if we apply the 10 tons dynamically, without any initial velocity or impact, the slab will, under that dynamic force, deflect $\frac{1}{4}$ in.; it will not, however, remain so deflected, but will oscillate or vibrate up and down at decreasing amplitudes, until, finally, it will come to rest at the static deflection of $\frac{1}{4}$ in.

Now, the time occupied in that first dynamic deflection of $\frac{1}{4}$ in. is determined by the law above referred to, as the *Acceleration of Elasticity*. The time is, in the example before us, the time of one beat of the pendulum $\frac{1}{4}$ in. long; because the law is, that a pendulum whose length equals the static deflection has a beat equal to the period of dynamic deflection. The period of pendulums varies as $\sqrt{\text{length}}$; and, as a pendulum 39 in. (=312 eighths of inches) long beats once every second, the time of $\frac{1}{4}$ in. deflection of the slab under notice will be=

$$\frac{\sqrt{1 \text{ eighth}}}{\sqrt{312 \text{ eighths}}} \text{ second} = 0.0566 \text{ second.}$$

Thus the force of gravity of the 10 tons load will have achieved its maximum result on the slab deflection in 0.0566 second. It does this when the 10 tons weight starts to descend from the normal level of the slab. The same weight of 10 tons will always achieve its maximum result or the full slab deflection in 0.0566 seconds from the first moment of contact, no matter what the level from which it starts to descend, and irrespective of the measure of slab-deflection its impact causes.

The accelerative force of the 10 tons in motion is determined by the duration of the accelerative motion. Thus if, instead of starting from normal level of slab, and enjoying 0.0566 second of resisted acceleration, the 10 tons were to start from a height 16 ft. above the normal level of the slab, it would then enjoy one second of free acceleration plus 0.0566 second of resisted acceleration. The accelerated force is measured by its duration solely; and, whether resisted or unresisted, the accelerative force of the 10 tons lasting, or operating, through a period of 1.0566 seconds, is as much in excess of the same force acting only 0.0566 second as 1.0566 exceeds 0.0566. Thus, in the example before us, the impact of 10 tons, falling 16 ft. on the slab, would exceed the dynamic stress of 10 tons weight without impact as 1.0566 exceeds 0.0566, *i. e.*, as 18⅔ exceeds 1. So the impact of 10 tons in the example before us is to the static weight or dead weight of 10 tons as 37⅓ to 1.

And inasmuch as (within the elastic limits of the slab's endurance) the deflection will vary in simple ratio to the accelerative force, the slab, in the example cited, in order to resist the impact of 10 tons falling 16 feet, would need an elastic endurance permitting of a deflection of 37⅓ by $\frac{1}{4}$ in., equal to 4⅔ in., which, of course, no concrete slab of ordinary dimensions could possess.

If, instead of a static deflection of $\frac{1}{4}$ in., the slab showed a greater static deflection, the impact would be less severe. But, on the other hand, if the static deflection were less than $\frac{1}{4}$ in., the impact would be more severe, the measure of severity varying in inverse ratio to the $\sqrt{\text{deflection.}}$

Thus it will be understood that the virtue of the extreme inflexibility of concrete floors renders the force of impact upon them peculiarly severe.

When all other things are equal, the larger the slab in proportion to its thickness the less severe will be the impact on its center. In any case the impact will be more severe from a weight falling on or near the solid bearings of the slab than from a weight falling on or near the center. A pavement slab on *terra firma*, if bedded on yielding rock, would be shivered by impact of a falling weight more easily than if bedded on yielding clay or mud.

This question of impact, however (important as it is scientifically, and also practically important in the construction of fortifications), has little, if any, practical importance in floors of dwellings, warehouses, and public buildings. There was a case in which some masons accidentally let a large mass of stone fall upon a concrete floor, near the summit of a building in course of erection; and the impact shattered the upper floor first, and every lower floor in succession. An accident of this kind does not, however, argue for rendering concrete floors proof against extraordinary impact. Every floor should be designed for the work it has to do; and no architect is reasonably called on to render his concrete floors proof against extraordinary impact, any more than he is called on to render the roof or vaulting of his church-nave proof against the impact of a falling spire struck down by lightning. So far as the writer is aware, in no case of ordinary roughest warehouse work has impact been known to shatter a well made concrete slab. And, ordinarily, there is no need to provide against it. The packing cases generally knock themselves to pieces, and so the floor is saved.

The window panes of houses, to say nothing of shops, are greatly more liable to be broken by impact than the concrete floors of warehouses. We do not on this account divide the house and shop windows by iron bars into exceedingly small panes; but if we do so, the effect would be, not to prevent impact from shattering the glass, but to localize the injury, and prevent it extending across the entire window. So, undoubtedly, by dividing concrete floors of great area into small squares by means of iron girders, we should not prevent impact from cracking the floor, but we should confine each crack to its own small square. But, seeing that concrete floors never are cracked by impact, is it worth while to incur the great expense of these iron girders, when they are of no use except to localize the effects of impact? It is a practical question, involving economy.

The case of Hayward's, Hyatt's, and other pavement lights may be adduced as practical evidence that there is wisdom in sub-dividing the squares into small areas. But are we then to conclude that, because Hayward, Hyatt, and others employ 6 in. by 6 in. lenses ¾ in. thick, therefore, we should make our concrete floors in 10 ft. squares 15 in. thick? The writer knows of a floor 10 ft. square by 4 in. thick, and an ugly hole cut out of one corner to allow of a spirial stairway; also of an extensive series of floors to a warehouse with many slabs 22 ft. by 12½ ft. by 13 in. thick; also of a crowded footpath on a public bridge where the self-sustained slabs are about 6 ft. square by 3 in. thick; and nothing like an impactive crack has manifested itself in either of these cases. Glass is undoubtedly more brittle than cement concrete. That is to say, the deflection of a slab of glass ¾ in. thick under its final load within its limit of tenacity would be less (considerably less) than the deflection of a slab of cement of same size and thickness under its final load at point of cracking. Hence impact on glass is more severe than on cement, and the pavement lights are made thick to suit. The briquette of neat cement is again much more brittle than the block of cement concrete. Indeed, the toughness of cement concrete is most remarkable, and involves a measure of comparative flexibility which renders the impactive stress on cement concrete much less severe than on neat cement, and still less than on glass.

To sum up: The outcome of the foregoing considerations seems to be, that it is an economical mistake to make concrete floors of spans so small as in common use—for concrete is capable of much higher endurance than it is generally believed to possess; and if a small part of the extravagant sums which are now wasted on iron girders, and on obstructive metal columns, were expended in procuring old, well seasoned cement, and in erecting and maintaining inflexible centering, the result would be more satisfactory, especially to the proprietor and to the fire insurance companies. For, all other things being equal, it is certain the less of iron used in a "fire-proof" structure, the more really fire-proof it is. If a large quantity of very inflammable stock were stored in a warehouse with roof, wall, and floors of concrete, without any iron anywhere, certainly the heat of the burning stock might cause such expansion of the large slabs and masses of concrete as to crack it in all directions. But even under the most unfavorable conditions it may be taken for granted that, for all practical uses, the warehouse would be as available with its cracks as without; and rarely, if ever, would the building be so injured by the fire as to require reconstructing.

These are some of the conclusions of many years' experience; and it would, perhaps, be well if others would publish their experience of concrete floors, etc.; for the subject has been by no means over discussed, or fully and finally dealt with, by the writers of this or preceding generations.

The question of economy of fireproof construction is a much larger question than at first sight would appear. It is not merely the question whether the wholesale firm of Messrs. Peace & Plenty shall pay for iron girders and not get a fireproof result; it is not merely the greater question of whether fireproof construction generally shall continue to be discredited and placed at a discount by reason of the non-fireproof character of those structures where iron has been so unsparingly

and unwisely employed. Wooden houses were thought good enough before the great fire of London. After the fire, wooden roofs and floors were still permitted, though wooden walls were disallowed. This was only a half step in civilization; and, up to the present time, our improvements stop far short of finality. Is it not true that in 1889 we still regard a fireproof building as a luxury? The great firms and the personal property and archives are to be secured from the devouring flame. But the more sacred and precious lives of the people are still to be risked nightly with nothing but the fire-engine and fire-escape as an alternative. Yet it is a fact that not only walls, but also roofs and floors of the dwellings of the people, can be constructed more strongly and quite as cheaply in fireproof as in a non-fireproof material. Here is the great field for economical and sensible employment of cement concrete. But so long as ignorant mistrust of the strength of concrete is accompanied by extravagant employment of iron, by presumptuously soon and sudden removals of centering carelessly erected, so long will the great and urgently needed improvement be arrested or hindered.

The great advances in the manufacture of Portland cement during the present decade have so cheapened and improved the material as to bring it more and more to the front. And, just as iron and steel have displaced timber from shipbuilding yards, so will Portland cement displace it from the building of houses (except as mere centering) when once the public get to understand that fireproof dwellings can be built as cheaply as the ordinary non-fireproof house or cottage.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Trustees of the village of Sing Sing, N. Y., have determined to abandon the use of oil and naphtha lamps in the public lighting. It is likely that this is a move to help along the local electricians, who, it is said, will be authorized to replace the oil lamps with specimens of the incandescent electric sort.

SOLICITOR HEPBURN, of the Treasury Department, has a novel point under consideration that had been referred to him in the ordinary course of business. A Company for the supply of electricity has established a plant at Niagara Falls, on the Canada side, with a view to ultimately extending its wires to Buffalo and intermediate points. Before investing their money on a large scale, the projectors thought it would be prudent to find out whether an electrical current generated in Canada and exported to the United States could be taxed under the customs laws of the States, hence the application to Solicitor Hepburn. If the Treasury Department is to be guided by the recent ruling of the Pennsylvania Supreme Court, who recently decided that "electricity as furnished for lighting and power purposes" could not be considered a manufactured article, the decision must be in favor of the exemption of electrical currents from the imposition of an import tax. Mentioning the decision of the Pennsylvania court prompts the query, "If the electrical current of commerce is not a manufactured article, how, then, shall it be classified?"

DR. BYRNE, who rejoices in the possession of an elegant summer residence and spacious grounds at Bay Shore, L. I., is about to institute suit against the local Gas Company, basing his complaint on the ground that escapes of gas from improperly-laid mains have killed several valuable shade trees.

THE authorities at Council Bluffs, Iowa, are advertising for bids for the public lighting of that place either by the tower or pole system of arc or incandescent lighting. Gas proposals are also asked for. The competition will terminate at noon of September 2d.

THE proprietors of the Montpelier (Vt.) Gas Light Company have determined to abandon the Hanlon-Ledley system, and substitute therefor a plant of the Peter English type. Supt. Medge says that the consumption of gas in Montpelier was never so great during the summer season as now.

THE Duplex Electric Gas Motor Company, of Edwardsville, Ills., has been incorporated by Messrs. J. Noble, F. A. Diergin, J. A. Gumersella, A. P. Wolf, J. H. French and W. H. Jones. The Company is capitalized in $1,000,000, and its purpose is to manufacture steam, gas and electric engines and appliances.

IT is more than likely that the adverse decision of the Board of Gas and Electric Light Commissioners on the petition of the Roxbury (Mass.) Electric Light Company to supply electricity will result in the dissolution of the enterprise. In fact a special meeting of the shareholders, for the purpose of considering the advisability of winding up the Company's affairs, was called for the 13th inst. A quorum, however, not being present on that date, the proposed discussion was adjourned to September 9th.

A CORRESPONDENT sends the following:—"The fire at Spokane Falls, W. T., although it did not injure the manufacturing portion of the Gas Company's possessions, nevertheless caused great loss to it, especially in the matter of meters, of which not less than 250 were rendered useless. All the pipe and fixture supplies in the office on Sprague street were ruined. Expensive valves, pipe cutters, threaders, cocks and many other valuable tools and appliances were warped out of shape. Shortly after the fire broke out the workmen of the Company removed the meters from many threatened buildings and stored them in vacant places, which latter were at the time supposed to be far removed from danger. To show how fierce and furious the flames were, I have only to say that the supposed haven with the stored meters was destroyed. The loss in office fittings was about $1,000, and the total loss will not be far from $4,500. The supplies of gas were shut off from the mains steadily as the fire moved northward, and the entire supply was cut off at 8 P.M. On the evening of the following Monday the gas was again turned on in the unaffected districts, and even to a tent in the burnt district. Superintendent Thompson says that he is in readiness to extend the service in response to calls from consumers, and expects to have many such made at once. Although the office of the Company was located in a small one-story frame building of light construction, the heat nevertheless was ardent enough to develop the worthlessness of a 'fireproof' safe. It turned over on its back, and as the heat increased the 'burglar-proof' lock released its grip and the doors swung open. The corner seams in the meantime had opened, and the 'absolutely fireproof' packing was spread on the floor. Fortunately the safe had been emptied some time before the flames caught the office structure. There can be no doubt about it but that the Gas Company's property was intelligently looked after during the conflagration, and had it not been for the destruction of the building in which the removed meters had been temporarily stored—it looked almost an impossibility that the fire could reach it—the loss would have been but very slight.—F."

IN the course of an interview between Mayor Fitler and a representative of the Philadelphia *Inquirer*, on the subject of the advantage and advisability of the city of Philadelphia establishing a municipal electric light plant, the Mayor said that plans for the establishment of such a plant had been under consideration for a long time. Continuing, he said: "The plans have not matured for the simple reason that we have no appropriation. If I had Aladdin's lamp, and could get my wish by rubbing it, one of the things I would immediately have would be an immense electric lighting plant. But we have to go through the business course of finding the money for these public improvements, and there are many other things that press upon us at present with more urgency than an electric plant." The idea of utilizing the waste heat at the gas works and the practicability of the combination of gas plant and electric lighting plant was mentioned, and the Mayor's familiarity with engineering practice was at once brought to bear upon the phases of the plan. He said this system of the attempted utilization of the waste heat of a large city establishment had been tried, but was quickly abandoned because of the difficulty of regulating the steam. The boilers placed in connection with the furnaces were rapidly burned out; there was a difficulty in regulating the steam; and at the establishment mentioned the blowing-off of the surplus steam created a great disturbance among the residents of the neighborhood. From all this it is fair to assume that Philadelphia will sooner or later operate an electric lighting plant in conjunction with her system of gas supply.

A PLANT for the manufacture of fuel gas is to be installed at Watertown, South Dakota. Local capital, at least so it is asserted, will control the venture. This place is the capital of Codington county, and has a population of about 7,500. An electric lighting enterprise is now being operated there, and at a profit. It is quite likely that illuminating gas will also be supplied under the fuel gas charter obtained for the place in question.

THEY are now calling that celebrated gas scheme for St. Louis the "Gas Steal;" but we imagine there is small probability of the "steal" ever becoming law. In any event, at a meeting of the City Council, held a fortnight ago, the Committee on Public Improvements, to whom the House of Delegates bill, conferring on Messrs. Branham, Johnson and Hardesty and associates a contract for the construction of a "municipal gas plant," to cost $4,500,000, submitted two reports. The majority report, signed by Messrs. Horton and Metcalfe, recommended that the

bill be filed. Mr. Vogel presented a minority report, recommending that further consideration of the measure be postponed till the fall season. In support of this request Mr. Vogel intimated that he had not had sufficient time to properly consider the bill, and was opposed to disposing of so important a measure in such a summary manner as was proposed by the majority of the Committee. Mr. Metcalfe, for the majority, contended that every Councilman had an abundance of time wherein to consider and discover the merits of the bill—if it had any—hence they should be in position to act on it at once. The discussion was confined by President Walbridge strictly to the question of the adoption of the report. On motion the minority report was accepted, the vote being 6 to 4, with the President in the affirmative. The latter, however, said that his vote should not by any means be taken as indicating that he favored the proposed grant. Mr. Vogel then submitted the following proposition on behalf of the Missouri Electric Light and Power Company: "*Resolved*, That if the city shall by ordinance duly authorized by law, and similar in terms to the ordinance now pending before the City Council, and known as House bill No. 283, grant to this Company the right or contract to construct gas works for the use of said city and to become its property as proposed and contemplated in said ordinance, this Company will covenant with said city to bind itself with adequate security fully to carry out the terms and conditions of the contract to be entered into by it with the city according to such an ordinance, and will bind itself in like manner with ample security, in addition to the construction of such works, to pay the city the sum of $250,000 as a bonus as may be hereafter agreed upon and provided." This proposition was referred to the Committee on Public Improvements. We make no doubt if the city of St. Louis will invite proposals from the capitalists of the country for the construction of a municipal gas works, on the lines proposed in "House bill No. 283," that the city could easily secure a bonus of $1,000,000. Without exception, the proposition of Branham and his associates is the neatest thing in the way of a bonanza that has been brought out for years. In fact, for audacity we think it has never been equalled.

THE lavish way in which the public arc lighting of Hartford, Conn., has been extended by the Common Council has at last directed attention to the great cost of the same. The Board of Street Commissioners are evidently desirous of keeping their skirts clear of the charge that this increased expense is incurred without warning of the same having emanated from them, at least we infer that this was the incentive which recently prompted them to send a communication to the Common Council. They note in their presentation of the situation that at the time the annual estimates were made last spring in respect to showing the probable expense of the department for the year, there were 359 electric and 195 naphtha lamps in use, and the amount appropriated was deemed sufficient to keep the lamps lighted during the regular schedule hours for the year. Since April first there have been established, by order of the Common Council, 19 new electric lamps, at a cost of about $880 per year. There has also been a much larger number of rainy and cloudy nights during the present season than usual, causing a necessary increase in the hours of lighting; and from the two instances mentioned such an increase in expense has resulted that a reduction in the hours for lighting will be necessary in order to keep within the estimate for the year. In concluding their hints the Board say: "As there are numerous applications for new lights, the Board deemed it necessary to inform the Council that the establishment of additional lights will cause the expense to exceed the estimate. This report is made in order that no misunderstanding may arise between the Court of Common Council and the Commissioners in regard to the matter." In the meantime the taxpayers seem to have no alternative, but must either submit to an inadequate illumination, resulting from an insufficient number of lamps or a curtailment in the allotted hours for keeping the same alight.

SOME comment has recently been made in San Francisco in respect to the number of gas street lamps reported by the department as "unlighted." It seems, too, that there was good ground for the comments; for President Crockett, of the San Francisco Gas Light Company, on being appealed to for an explanation of the trouble, said: "Our Company has encountered a difficulty which has been experienced by gas companies in Eastern cities, but never until recently in San Francisco, namely, naphthaline. It forms in the shape of small crystals, which collect in the elbows of the small pipes in the lamp posts, stopping them up, and thus preventing the gas from reaching the burners. The formation of these crystals is caused by changes in temperature, and the way to remove them is by pumping liquid naphtha into the pipes. The trouble has only appeared in the last few weeks, and I cannot understand why it should come now when we have been free from it heretofore. The lamplighters are required to report when a lamp is out of order, but so many cases have come in that it has been impossible to take care of them at once. One hundred and twenty-six cases were reported in one day. We have secured a large quantity of naphtha, and have a force of men and wagons at work remedying the evil wherever found. Every lamp that is not lighted is counted and the city given credit in the monthly bills. We are giving the city all we charge for, and are prepared to meet an investigation by the Street Lighting Committee at any time.

THE following proposals were submitted to the authorities for the public lighting by electricity of the streets of Greenbush, N. Y.: The Edison Light and Power Company, 125 (25-candle power) incandescent lamps, at $18 each per annum; 60 (1,200-candle power) arc lamps, at $75 each per year; Mohawk Valley Electric Company, 125 incandescents, for $2,345 per year; 60 arcs, at $4,800 per year; the East Albany Gas Light Company offered to furnish arc lights (1,200-candle power) on the basis of 20 cents each per night, or incandescents (25-candle power), for the sum of 5½ cents each per night. The contract is to run for 5 years, and the bids were taken under advisement.

THE projectors of the Wadhams Oil and Grease Company have applied to the Milwaukee (Wis.) Council for a franchise that will enable them to lay pipes for the distribution of oil for fuel and lighting purposes in that city.

MAYOR GARDNER of Cleveland, Ohio, is agitating the matter of the appointment of an official inspector of gas, the salary of that official to be assessed on the local gas suppliers.

Engineering notes that a delegation of American workpeople to the number of forty-six men and four women left this city on July 24 to pay a visit to the Paris Exhibition. After arriving in Liverpool it was arranged that they should proceed to visit a number of works and factories in England, which plan delayed their arrival in Paris until the middle of this month. This band of fifty persons represents as many separate industries. The members of the delegation were elected by various labor syndicates in different parts of the United States, and their expenses are defrayed by an association called the "Scripp's League," a combination of various *Journals* in different parts of the country. The party is accompanied by several newspaper correspondents, artists and photographers, and a part of the duties of each workman will be the preparation of a report concerning his own particular industry. These reports will, on the return of the delegation, be printed and published in a single volume. It is somewhat to be regretted that the labor delegates sent over to Paris by the Mansion House (England) are not likely to prepare and publish reports; for a comparison of criticisms by English and American workmen would be of great interest, and would convey a clear idea as to the relative capacity for observation of workmen on each side of the Atlantic.

THE Grafton Gas and Electric Light Company, organized for the purpose of establishing gas and electric works in Grafton, Taylor county, West Va., has been chartered. The Company is to have a life of 50 years, is to have a maximum capital of $50,000, and is controlled by Messrs. George Brinkman, Jno. T. McGraw, Leonard Mallonee, H. Miller, J. W. Hamilton and J. F. Lagge. This place is a post village of Taylor county, on Tygart's Valley River, and on the B. & O. Railroad at the Parkersburgh Branch junction. It is 280 miles west of Baltimore and 99 miles southeast of Wheeling. It is a flourishing place, and has a population not far short of 6,000.

MR. FLANIGEN, who is in control of the fortunes of the Athens (Ga.) Gas Light Company, although in possession of an iron-clad contract with the authorities for the lighting of the streets by gas—which contract has five years yet to run—has, in deference to the seeming desire of the residents for arc lighting, submitted a proposition for a mixed system of lighting by gas and electricity.

PRESIDENT ADDICKS has informed "those whom it may concern" that the name of the "Peninsular Investment Company" has been changed to that of the "Bay State Gas Company."

ABOUT a fortnight ago the Denver (Col.) Board of Aldermen passed a resolution granting the Peoples Gas Light Company (one of those wretched floating schemes, the only purpose of whose organizers is commercial blackmail) a continuation of the time for renewing its franchise from October 1, 1889 to October 1, 1891. The talk caused by this action

roused some of the Board to a sense of their duty, and at a later meeting it was moved to reconsider the extension. The motion was lost, being just short of the necessary two-thirds endorsement.

IT gives us pleasure to be able to say that the board bill of Mr. Geo. N. Torrence—mentioned in our last issue as the gentleman who wished to purchase the Cincinnati Gas Light Company—has been settled.

ON Wednesday next the Board of Gas and Electric Light Commissioners will give a public hearing on the appeal of the Dedham and Hyde Park Gas and Electric Company from the Decision of the Selectmen in granting the right to locate poles, etc., to the Dedham Electric Company.

WORK on the plant of the Williamstown, Mass., gas works is again under way. The Company will no doubt supply gas this winter.

AN effort will be made at the coming session of Congress to induce our national lawmakers to authorize the Commissioners of the District of Columbia to engage in the necessary steps for the installation of a municipal gas plant. This time the agitation is to be under the auspices of the Nationalist Club, of which interesting collection of mosaics a certain Mr. W. W. Wright is President. Is it not about time that the Washington Gas Light Company was freed by Congress from the annual assaults made upon it?

A QUEER accident is reported from Gloucester, N. J. About a fortnight ago Philip Birch, a clerk in the Gloucester City Electric Light Company's office, while swimming, made an extra long stroke, dislocating his shoulder blade. Although at a considerable distance from shore he managed to swim to it with the sound arm.

MESSRS. EX-JUDGE W. L. FOSTER and Jno. M. Mitchell are in Chicago, having gone there for the purpose of taking depositions in the case of the United Gas Improvement Company against the Manchester (N. H.) Gas Light Company, for breach of contract, now pending in the United States Circuit Court for the Manchester district. It will probably be remembered—for the case was reported in the JOURNAL shortly after the suit was originally instituted—that the alleged breach of contract consists in the refusal of the defendant to accept a water gas plant which complainant claims it was authorized to construct.

THE proprietors of the Belleville (Ills.) Gas Company have decided to reduce the selling rate to $1.50 per 1,000 cubic feet. The prior rate was $1.75. This concession guarantees very cheap gas to the residents. The Company is doing a very good business.

THE proprietors of the Rutland (Vt.) Electric Light Company have brought suit against the authorities to compel payment of a public lighting bill of $15,000.

MR. P. D. WANNER, the wide-awake and capable Chairman of the Mellert Foundry and Machine Company, recently gave it as his opinion that while there are larger demands now on the pipe foundries than those made one year ago, it is nevertheless a fact that the demand is not equal to the capacity for supply. He also notes that prices are lower now than they have been at any time since the 1st of July, 1879. Another sensible remark made by him is anent the practice of certain engineers to insist on special castings, the only merit in the latter seemingly being in line with diversity. Mr. Wanner says: "If engineers will compel foundry men to get up pipe and specials to suit their own particular fancies, the cities and towns for which such pipe and castings are proposed should be willing to pay for them. The fixtures required for any size of pipe, particularly the larger ones, can only be had by a large outlay of money, and when pipe is sold without profit, it would be foolish for a pipe maker to assume to make a pipe of an unusual size unless he would get a figure above such ruling price."

THE Oakland (Cal.) Gas Light and Coke Company has added a new 300-horse power engine to its electric power station. This will give the Company a total motor force of 800 horse. The dynamo equipment is also being greatly increased. In fact, when the present plan of betterment shall have been completed the Company can count on current from 24 machines, the minimum capacity of the latter being 35 lights, going from that to a maximum capacity of 55 lights. Oil is largely used as fuel by the Company, and the arrangements for storing it are on a very complete scale.

THE projectors of the Waterloo (Can.) Gas Company are arranging to receive estimates for the construction of the plant.

THE plan of regrading the streets adopted by the authorities of Alameda, Cal., will necessitate many changes on the site occupied by the local gas works.

THE gas plant for Mystic Bridge, Conn., the formation of a Company for the construction and operation of which was formerly noted by us, is assured. As we understand the situation there, the only trouble so far encountered is the inability of the contractors who secured the contract for pipe and specials to quickly furnish these materials.

AT the auction sale of 1,000 shares of new stock in the New Bedford (Mass.) Gas Light Company—the issue being made for the purpose of paying off the indebtedness incurred in the construction of its electric lighting annex—spirited bidding resulted in the payment of large premiums for the shares. The securities, which were offered in certain lots, were bought in at prices ranging from $131¼ per share to $135½. The closing sale was effected at $134, and at least double the amount of the issue could have been disposed of at the rates noted.

THE National Gas Light and Fuel Company has closed a contract with the Aberdeen (Dakota) Light and Fuel Company for a plant of the Springer type, rated to a daily make of 80,000 cubic feet.

IN accordance with our prior intimation that such a step was to be taken, the capital stock of the Cincinnati Gas Light and Coke Company has been increased from $6,000,000 to $6,500,000. The issue (which is to go at par to stockholders of record of Aug. 24) is made to cover the improvements in duplicating the plant and in the extension of mains—about 15 miles of the latter are put down each year. Gen. Hickenlooper, in speaking about the matter to a reporter of the *Times-Star*, said: "Our plant improvement in keeping pace with increased output is such that every five years or so we increase our capital stock to meet the emergencies created by the progress of our city. Each stockholder will be entitled to 1 share for every 12 held by him. For fractional shares no certificates will be issued, but these will be cashed by the Company on the basis of $210 per share, and will be afterwards consolidated into full shares and then be put upon the market. The transfer books will be closed from Aug. 24 to 31."

LAST week Engineer Smedberg, who is temporarily located in Hamilton, Ohio, at which point he is in charge of the construction of the municipal gas works, had a narrow escape from a shocking death. Mr. S. and family were driving through the city, and the coachman, recklessly paying no heed to the bell announcing the approach of a railroad train, crossed the tracks and barely missed being struck by the eastbound fast Indianapolis express.

THE proprietors of the Amherst (Mass.) Gas Company have closed a contract with the Westinghouse Electric Company for a 500 incandescent electric light plant, based on the central station principle. Work on the same is now in progress.

IN our last we published an account, from an occasional correspondent, of the electric lighting annex of the Woonsocket (R. I.) Gas Light Company, and to the same pen we are now indebted for the following briet mention of the Company's water gas plant: "The Company, which is now making only water gas, commenced to suppply this article for illuminating purposes on April 1, 1889, and, although the coal gas plant is not under fire, Supt. Jenks nevertheless has it in perfect readiness to be started at a moment's notice. Two complete sets, or, rather, one double set of the Granger-Collins type, comprise the works, and the manufacturing capacity of the sets is 250,000 cu. ft. per diem. The building in which the apparatus is housed is situated between Hamlet avenue and the New York, Providence and Boston Railroad. It is a one-story brick structure, with basement, 42 feet 8 inches by 23 feet 8 inches. The height from the ground to the trusses is 26 feet 4 inches. The basement, divided by a brick wall into two rooms, is 6 feet 3 inches in height, and is of the same dimensions as the ground floor. The main room, which contains the generator, superheater, scrubber and condenser, is 30 by 21 feet. In the rear of this is a smaller room, 8 feet 4 inches by 21 feet, in which are the engines, blower and pumps. The engines are of the Westinghouse type, and are controlled from the main room. The corrugated iron roof is pierced by two stacks. Of course, I need not weary you with a description of how water gas is made, and I will close this brief note with the remark that Superintendent Jenks was led to the adoption of the water gas process here chiefly because the demand for gas in Woonsocket—it is wholly a manufacturing city—is of the decidedly spasmodic sort. For instance, the difference betwixt the sendout on ensuing days may be and often is as great as 65 per cent. Gas engineers

know what this great difference means, and at Woonsocket the plan adopted was to install the generators. The candle power of the gas supplied averages 20.

Some time ago we noted the incorporation (in Chicago) of the United States Gas Consumers Protective Company. The original object of the concern was to test gas meters, but its prime movers—Messrs. Edward C. Stebbins, Thomas F. Moran and Wm. Bleckert—apparently have decided that the original purpose was not of sufficient scope for their energies. At any rate they have since amended the articles of incorporation by adding the words, "and deal in all kinds of gas appliances."

We understand that W. A. Styles, President of the Middleboro Electric Light and Power Company, has made an offer of $17,000 to the proprietors of the Middleboro Gas and Electric Light Company for the plant and franchises of the latter. This offer, however, is not likely to be accepted, as it is far below the value of the property sought to be obtained.

It is said that the Galveston (Texas) Gas Company will expend $100,000 in the construction of a water gas annex to its existing plant.

Advices from Columbus, Ohio, announce that the Ohio Gas and Construction Company has been incorporated with a capital stock of $500,000. The incorporators are David Morison, F. E. Bliss, M. M. Hobart, P. M. Spencer and Orlando Hall. The objects of the Company, as stated in the charter, are: "The manufacturing and selling of machinery for making gas from crude oil or other products, and the organization and construction of gas, water and electric light works, etc."

In the amended articles of incorporation of the Lincoln (Neb.) Gas Company, Article 1 recites that the purpose of the Company is to purchase, hold and own suitable grounds in the city of Lincoln to erect and maintain buildings and works for the manufacture and purification of illuminating and fuel gas and electricity, for illuminating, power, mechanical and chemical purposes, and manufacturing, selling and supplying such gas and electricity to individuals, corporations and associations, and to the public buildings and institutions situated in the city or adjacent thereto. Article 4 is to the effect that the capital stock, together with that in existence, is increased to $325,000, and that $100,000 of the additional stock shall be issued and divided among the present stockholders; that the residue may be issued to others for money, machinery, patents or other property appliance that may be necessary or convenient to carry on the business of the institution. The Board of Directors is thus composed: H. J. Walsh, H. C. Saunders, George W. Hamlin, Geo. M. Walsh and Amada M. Putnam.

Mr. Alfred Wilson has resigned from the service of the East Portland (Oregon) Water Company, in order to accept the position as Manager to the Astoria Gas Company. He is a good business man.

Winthrop, Mass., is to have an electric light company, such a venture having been recently incorporated by Messrs. Elliott Wood, A. H. Bailey, C. D. Wood and L. T. Carlton.

The effect of the decision of the Gas Commissioners has been to spur the Boston Electric Lighting Company up to the point of providing electrical illumination for the Roxbury district. The site selected is just opposite the West End Street Railway Company's station.

Report of the Directors of the Gas Light and Coke Company.

The following is an abstract of the report submitted to the proprietors of the Gas Light and Coke Company (London) by the Board of Directors, concerning the Company's operations for the first half of 1889:

In the year 1883 the Directors placed before the proprietors a statement of the most prominent features of their undertaking, and it will be interesting again to note its further development and progress.

At that period the quantity of coal carbonized by the Company was 1,500,000 tons per annum. This has now increased to 1,750,000 tons, The total annual quantity of gas made by the Company, and distributed to the public, has risen from 15,000 millions cubic feet to nearly 19,000 millions. The greatest day's consumption, which during the winter 1882-3 was 95,000,000, was last winter upwards of 105,000,000 cubic feet; and on that one day the quantity of coal used was 10,146 tons, or at the rate of nearly 425 tons per hour. The price of gas, which in 1883 was 3s. 2d. per 1,000 cubic feet, has been reduced to 2s. 6d. (and in the case of the public street lamps to 2s. 2d.) per 1,000 cubic feet; and the impulse thus given to the consumption of gas for cooking and many other purposes proceeds unchecked. The 1,700 miles of mains then laid in the Company's districts have been extended to nearly 1,850 miles. The consumers, who in 1883 were 185,000 in number, have now grown to 206,000. The 45,000 public street lamps then lighted by the Company have increased by about 5,000. In place of the 17 locomotive engines in use at the Beckton Station, 24 are now required and at work. To complete the comparison, although there has in the interval been no appreciable addition to capital expenditure (which now stands at £10,500,000 sterling), the annual income of the Company, which in 1883 amounted to £3,000,000, has, notwithstanding the recent large reductions in the price of gas, increased by about £160,000; and the dividend paid to shareholders, which then was 11 per cent., had last year advanced to 13 per cent.

In an undertaking of such magnitude, employing servants varying according to the season of the year from 5,000 to 9,000 in number, provision has necessarily to be made for the care of their bodily health; and the Directors on this point refer to the statement of the Company's consulting physician, compiled from the monthly returns of the several district medical officers, and herewith distributed to the proprietors, which shows that the health of the men engaged in the various occupations connected with the Company's manufacture and distribution compares favorably with that of so fine a body of men as the Metropolitan Police. Sick and Provident Funds, to which the Company at present contributes £2,700 a year, exist, and are managed by committees of the workmen, which exercise the right of nominating the district medical officers above mentioned.

Every workman in the carbonizing department who has been regular and punctual throughout the year obtains a week's holiday, without loss of pay, and men of long and faithful service, who have become disabled by age or have sustained injury in the performance of duty, are considered eligible for pensions.

During the past half-year a movement has taken place among the stokers employed by the Company in favor of shorter hours of duty. Under the system till now in operation, the gangs have worked in two shifts of 12 hours each. The pay of the carbonizing staff in the Company's service, for 12 hours' attendance, has been as follows, viz:

Firemen	5s. 11d.	per man per day.
Scoop drivers	5s. 6½d.	" "
Stokers	5s. 4d.	" "

The men, although nominally on duty for twelve hours, have never actually been at work for more than six; the remaining six hours being devoted to rest and meals. Sunday working, between the hours of 6 A. M. and 6 P. M., has been reduced to a minimum, and is practically abolished, except in cases of exigency of weather, when the men engaged receive additional pay at the rate of 50 per cent. The men, however, contend that twelve hours at a stretch of retort house duty, the work at intervals being carried on in great heat, is of an exhausting nature, and that the bodily fatigue and the time they are absent from their homes afford them no leisure to devote to their families or to self-improvement, and (while the medical statistics above referred to dispose of their contention that their health suffers through the long hours of duty) and the Directors feel that there is some ground for supposing that a three shift system of eight hours, in place of two shifts of twelve hours, would, though necessarily more expensive to the Company in the cost for wages, be better for the men, and enables them to carry on their work under the least trying conditions. They have therefore reduced the day's work from twelve hours to eight hours, with a proportionate reduction in the number of retorts to be charged and drawn; and they believe that, under the new system, they will, while improving their condition, obtain more efficient work from the men. The increased cost for carbonizing wages, in consequence of more men being required, will amount to about £50,000 a year.

Public attention has also been widely drawn, during the past six months, to the launching of water gas companies; and some few proprietors have manifested anxiety at the possibility of another competitor with coal gas for general lighting. The Company's Chief Engineer is now engaged in experiments to test the value of water gas as an adjunct to the Company's present manufacture, with a view to its utilization should it be proved to be efficient and economical. Water gas in itself is not suitable for lighting purposes, but must be used in connection with some illuminating medium. When enriched and otherwise dealt with it can be used as an illuminant, and is so used in America and other places where coal is costly.

The Directors view the threatened competition of the whole of these companies without alarm. London, at the present day, contains upwards of 550,000 houses, more than half of which are still unsupplied with gas, and are, to a great extent, situated in such localities as are unlikely ever to become attractive to the promoters of more costly illuminants. The Directors are actively pushing the Company's trade in these districts, and are introducing into the dwellings of the working classes the advantages of heating and motive power, ventilation and light, by means of coal gas, on conditions of payment which are within the means of the poorest.

The advantages of the use of gas as fuel for cooking and warming, and as a motive power for machinery, are becoming more marked every month—indeed, the Directors have difficulty in providing stoves rapidly enough to meet the demand.

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Report of the Gas Inspector, District of Columbia.

Mr. S. C. Ford, the inspector of gas and meters, states in his annual report to the District Commissioners that during the year the illuminating power and purity of the gas supplied by the Washington Gas Company were as follows: Average illuminating power, 17.32 candles; highest illuminating power, 20.39; lowest illuminating power, 16.01. On five occasions during the year, the report says, the gas furnished by the Washington Company contained more sulphur than the 20 grains allowed. The average pressure of the gas furnished was 1.24 inches.

The illuminating power and purity of the gas supplied by the Georgetown Gas Company were as follows: Average illuminating power, 17.09 candles. The highest illuminating power during the year was 19.78 candles, and the lowest 11.36 candles. On 13 occasions, the report says, the illuminating power of the gas furnished by the Company was found to be less than 16 candles. On 15 occasions the quantity of ammonia found in the gas exceeded the amount allowed, and on 16 occasions the amount of sulphur found in the gas was in exce s of the quantity allowed. The average pressure of the gas during the year was 1.64 inches.

During the year 1,568 meters were inspected and proved. The results of inspection were as follows: 76 registered fast, average error 4.09 per cent.; 38 registered slow, with an average error of 6.10 per cent.; 1,449 registered within the limits allowed, namely, 2 per cent. either way, and 3 did not register the gas flowing through them; 85 of the above were inspected and proved on complaint; 68 were complained of by consumers of gas; 38 registered fast, average error 3.33 per cent. During the year $784 was collected. The report says, further, that the laboratory established in the central part of the city does not receive its supply from the new works of the Washington Gas Light Company in square 1,025, between M and N and 12th and 13th streets, southeast. For this reason the inspector has no means of ascertaining the illuminating power and purity of the gas furnished by these works. Mr. Ford recommends that a laboratory be established at a suitable point in that section, and provided with the necessary instruments. He renews his recommendation that an assistant inspector of gas and meters be appointed, and that the Act of Congress regulating gas works in the District be amended so as to require, when for any purpose whatever the heads of meters that have been inspected, proved and sealed are removed by the gas companies, meters of this description should be classed as repaired meters and brought to him for re-inspection.

Radiating Power of Flames.

At a recent meeting of the Berlin Physical Society Dr. R. Von Helmholtz communicated the results of his experiments on the radiating power of flames. The problem which he had set before himself was to determine the relationship between the radiant energy of flames and the amount of gas consumed for their production. The latter was measured by the fall of the gasometer globe which contained the gas, the former by means of a bolometer, for each of whose scale divisions the equivalent value in heat units had been carefully determined by three different methods. The radiating energy of the flames depended upon a number of conditions which were each severally investigated; as, for instance, the size and shape of the flames, the amount of foreign gases introduced, and the ratio of the amount of oxygen to the amount of gases with which it was mixed. For the purposes of comparative measurements a moderately high flame was chosen, which produced no smoke, and was six mm. thick. Luminous flames radiated more energy than non-luminous, and it was proved by an extended series of careful quantitative experiments that the radiating power of the flames was not dependent upon their temperature. From this it follows that Kirchoff's law does not hold good for flames—a result which is, however, quite in accordance with the limitations he put to his law for those cases in which heat is directly converted into radiating energy. In the case of flames it must be borne in mind that chemical affinity comes additionally into play; the speaker entered fully into the influence of this upon the radiation of energy, and endeavored to make it clear by means of an extremely interesting hypothesis. After this he stated the numerical data which he had obtained for both luminous and non-luminous flames, produced with a series of gases—hydrogen, carbonic oxide, methane, coal gas, methyl alcohol, etc. Starting as a basis with Julius' statement that the products of combustion are the only criteria of the amount of radiation, and hence calculating the radiating energy of the flames, he obtained values which corresponded very closely in most cases with those actually observed. Finally he calculated the total useful effect which can be obtained as radiant energy from the gases which are being consumed in the production of the flame. From this he arrived at the interesting result that it is far more economical to use the gases for driving a dynamo which supplies incandescent lamps, and to utilize the energy radiated from the latter, than to burn the gases and utilize the energy which is radiated out from their non-luminous flames.

The Market for Gas Securities.

During the latter part of the week a stringency in money, which is worth 6 per cent. today (Friday, Aug. 23), caused a decided check in speculation, with consequent dullness and heaviness in prices. Consolidated sold up to 87¼ within the week, but is now at 86 to 86½, with little or no inquiry for the shares. Equitable is somewhat lower, while Mutual holds its own. Brooklyn shares show no change. Chicago Trusts dropped sharply, from 61 to 58, but this depression is chargeable solely to the squeeze in the money market. Baltimore Consolidated is lower at 44½ to 44¾. Citizens, of Newark, is bid for at 155, the offering rate being 160. The auction sale at Toronto, last Tuesday, of $175,000 of new stock in the Consumers Company, of that city, was well attended, and good figures were realized. The range was 175 to 175¼, and the stock was offered in blocks of 10 shares, of a total of 350 parcels. The new stock in the Cincinnati Company will be alloted this week, the books having been closed on the 24th, to be reopened Saturday.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

AUGUST 26.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	86	86¼
Central	500,000	50	—	—
" Scrip	220,000	—	—	—
Equitable	4,000,000	100	121	125
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	116	118
Mutual	3,500,000	100	102	103
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	60	70
" Bonds	15,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	107	109
Citizens	1,200,000	20	65	70
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	126	127
" Bonds	300,000		—	106
Peoples	1,000,000	10	74	76
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	88	91
Nassau	1,000,000	25	110	—
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	118	120
" Bonds	1,000,000	—	109	112
Out of Town Gas Companies.				
Boston (Mass.) Gas Co	2,500,000	500	240	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	57⅛	57⅞

Cincinnati G. & C. Co..	6,000,000	100	214	218
Consumers Toronto....	1,000,000	50	190	200
Central, S. F., Cal.....			80	90
Capital, Sacramento, Cal.			58	
Consolidated, Balt.....	11,000,000	100	44⅜	44¾
" Bonds.....	6,400,000		107	107½
Hartford, Conn.....	750,000	25	120	130
Jersey City.....	750,000	20	175	180
Laclede, St. Louis, Mo.	2,000,000	100	140	—
Louisville, Ky.....	2,570,000	50	125	130
Little Falls, N. Y.....	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada.....	2,000,000	100	200	208
Memphis (Tenn.) Gas...	750,000	100	48	51
" Bonds.	240,000	100	103	—
New Haven, Conn.....		25	200	—
Oakland, Cal.....			35	35½
Peoples, Jersey City...		—	60	61
" " Bonds..			—	—
Paterson, N. J.....		25	99	102
Rochester, N. Y.....		50	99	100
Syracuse, N. Y.....	500,000	25	—	—
St. Louis, Missouri.....	600,000	50	—	750
San Francisco Gas Co.			60	60½
San Francisco, Cal....	10,000,000	100	59¾	60
Washington, D. C.....	2,000,000	20	195	198
Wilmington, Del.....		50	200	208

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 296
Wm. Henry White, New York City ... 287
Wm. Mooney, New York City ... 296
William Gardner, Pittsburgh, Pa ... 296
Fred. Bredel, N. Y. City ... 295

CHEMISTS.

Durand Woodman, New York and Newark, N. J ... 285

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills ... 290
Bartlett, Hayward & Co., Baltimore, Md ... 297
Wm. Henry White, N. Y. City ... 287
United Gas Improvement Co., Phila., Pa ... 289
Henry Pratt & Co., Chicago, Ill ... 298

GAS AND WATER PIPES.

Gloucester Iron Works, Phila., Pa ... 296
Meilert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 296
Ohio Pipe Co., Columbus, Ohio ... 296
M. J. Drummond, New York City ... 296
R. D. Wood & Co., Phila., Pa ... 298
Warren Foundry & Machine Co., New York City ... 296
Donaldson Iron Co., Emaus, Pa ... 296
Dennis Long & Company, Louisville, Ky ... 296

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 299
Continental Iron Works, Greenpoint, L. I ... 299
Delly & Fowler, Phila., Pa ... 299
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 298
Stacey Mfg. Co., Cincinnati, Ohio ... 299
Bartlett, Hayward & Co., Baltimore, Md ... 297
Morris, Tasker & Co., Limited, Phila., Pa ... 297
Davis & Farnum Mfg Co., Waltham, Mass ... 250
R. D. Wood & Co., Phila., Pa ... 298
Bouton Foundry Co., Chicago, Ills ... 299
Smith & Sayre Manufacturing Co., New York City ... 299
Fred. Bredel, N. Y. City ... 295
United Gas Improvement Co., Phila., Pa ... 289
Henry Pratt & Co., Chicago, Ill ... 298
National Gas Light and Fuel Co., Chicago, Ills ... 290
Simpkin & Hillyer, Richmond, Va ... 284

INCLINED RETORTS.

Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 287

GASHOLDER TANKS.

W. C. Whyte, New York City ... 290
J. P. Whittier, Brooklyn, N. Y ... 285

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass ... 285

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J ... 294
B. Kreischer & Sons, New York City ... 294
Adam Weber, New York City ... 294
Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 294
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 294
Borgner & O'Brien, Phila., Pa ... 294
James Gardner, Jr., Pittsburgh, Pa ... 294
Henry Maurer & Son, New York city ... 295
Chicago Retort and Fire Brick Co., Chicago, Ills ... 295
Baltimore Retort and Fire Brick Co., Baltimore ... 294
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo ... 294
Emil Lenz, New York City ... 294

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md ... 297
Fred. Bredel, New York City ... 295
Chicago Retort and Firebrick Co., Chicago, Ills ... 295
Wm. Henry White, N. Y. City ... 287
J. H. Gautier & Co., Jersey City, N. J ... 295

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 288
R. D. Wood & Co., Phila., Pa ... 298

GAS GOVERNORS.

Connelly & Co., New York City ... 291
Fred. Bredel, N. Y. City ... 295
Friedrich Lux, London, England ... 285

SELF-SEALING MOUTHPIECE DOORS.

Smith & Sayre Mfg. Co., New York City ... 291

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page, N. Y. City ... 252

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y ... 294

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio ... 300

GAS METERS.

Harris, Griffin & Co., Phila., Pa ... 302
American Meter Co., New York and Philadelphia ... 303
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 303
Helme & McIlhenny, Phila., Pa ... 303
D. McDonald & Co. Albany, N. Y ... 303
Nathaniel Tufts, Boston, Mass ... 302
Maryland Meter and Manufacturing Co., Baltimore, Md ... 256
John Hillen, Brooklyn, N. Y ... 302

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind ... 286
Smith & Sayre Manufacturing Co., New York City ... 299
Wilbraham Bros., Philadelphia, Pa ... 291
Connelly & Co., New York City ... 291

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 301
Perkins & Co., New York City ... 300
Newburgh Orrel Coal Co., Baltimore Md ... 301
Despard Coal Co., Baltimore, Md ... 301
Chesapeake and Ohio R.R. Coal Agency, N. Y. City ... 301
Westmoreland Coal Company, Phila., Pa ... 301
J. & W. Wood, New York City ... 300

CANNEL COALS.

Perkins & Co., New York City ... 300
J. & W. Wood, New York City ... 300

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y ... 292
John McLean, New York City ... 292
Chapman Valve Manufacturing Co., Boston, Mass ... 292
R. D. Wood & Co., Phila., Pa ... 298

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa ... 304
Clerk Gas Engine Co., Phila., Pa ... 292
Van Duzen Gas Engine Co., Cincinnati, Ohio ... 292

ENGINES AND BOILERS.

Jarvis Engineering Co., Boston, Mass ... 291
Ball Engine Co., Erie, Pa ... 285
Westinghouse Machine Co., Pittsburgh, Pa ... 286

GAS LAMPS.

G. Shepard Page, New York City ... 256
Standard Gas Lamp Co., Phila., Pa ... 286
Welsbach Incandescent Gas Light Co., Phila., Pa ... 287

PURIFIER SCREENS.

John Cabot, New York City ... 292
Geo. A. Mills, Baltimore, Md ... 292

GAS STOVES.

American Meter Co., New York and Philadelphia ... 293
The Goodwin Gas Stove and Meter Co., Phila. Pa ... 268

STREET LAMPS.

J. G. Miner, Morrisania, New York City ... 285
Bartlett Street Lamp Man'fg Co., New York City ... 245

BURNERS.

C. A. Gefrorer, Phila., Pa ... 301

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City ... 292

PURIFYING MATERIAL.

Connelly & Co., New York City ... 291
Friedrich Lux, London, England ... 285
Edgewater Lime Works, Edgewater, N. J ... 285

COKE CRUSHER.

C. M. Keller, Columbus, Ind ... 301

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City ... 287

BOOKS, ETC.

Gerould's System Gas Bookkeeping ... 285
Goodwin's Directory of Gas Light Companies ... 295
King's Treatise ... 296
Scientific Books ... 302
Management of Small Gas Works ... 292
Gas vs. Electricity ... 294
Practical Electric Lighting ... 291
Electric Light Primer ... 291
American Gas Engineer and Superintendents' Handbook ... 301
Digest of Gas Law ... 285

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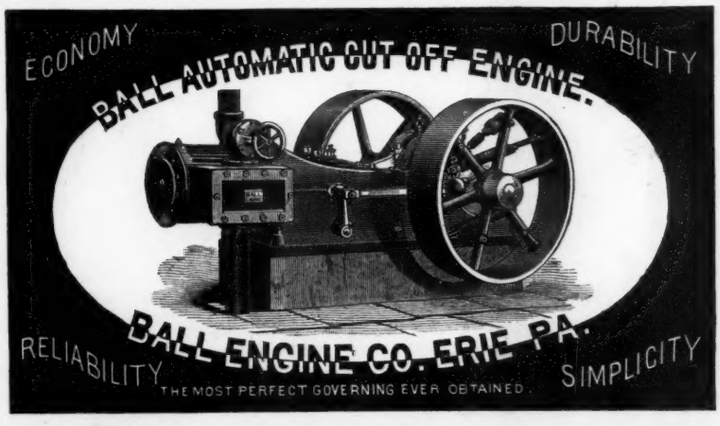

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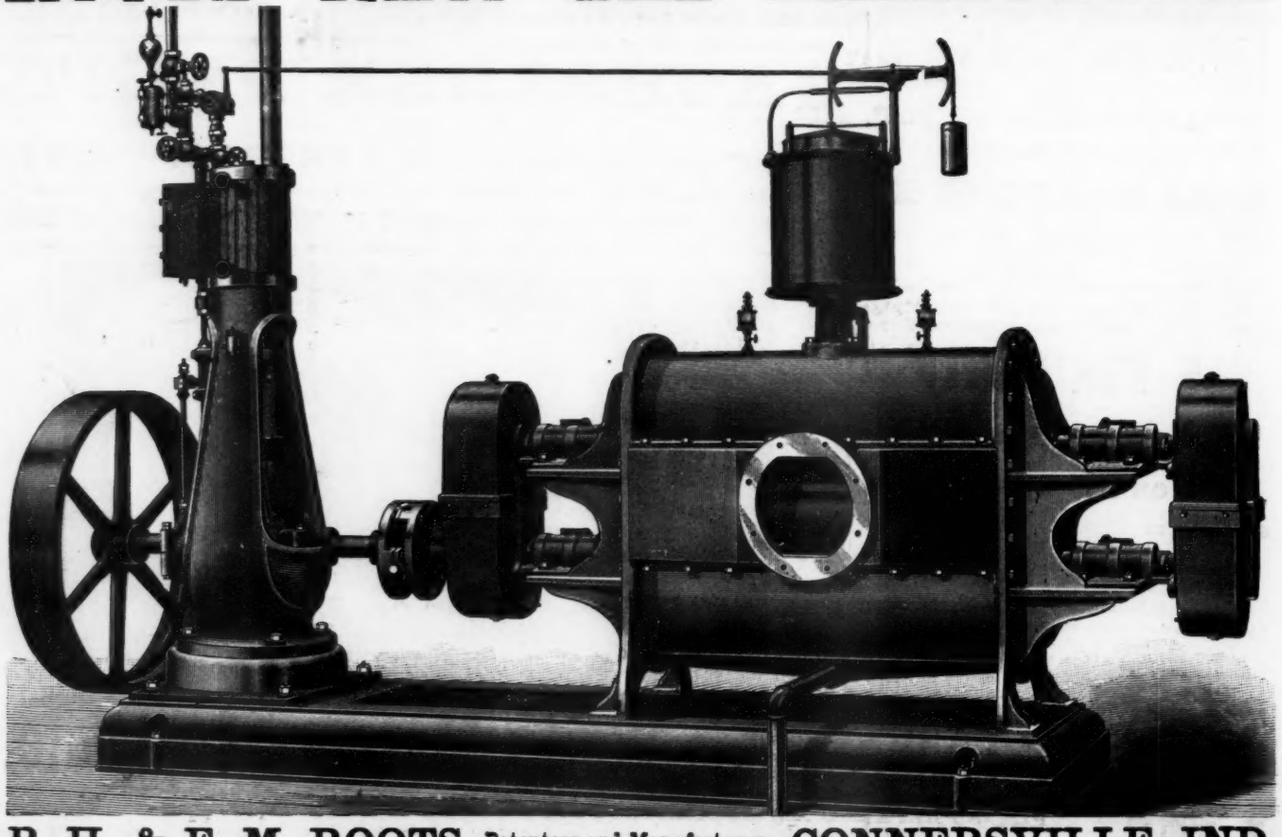

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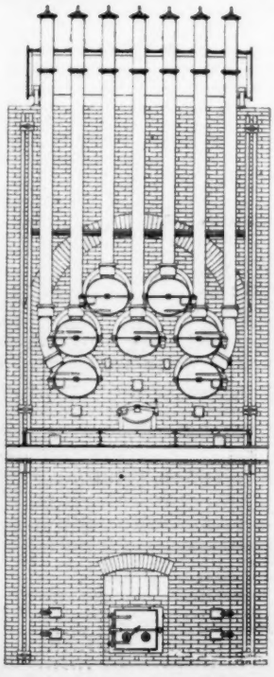

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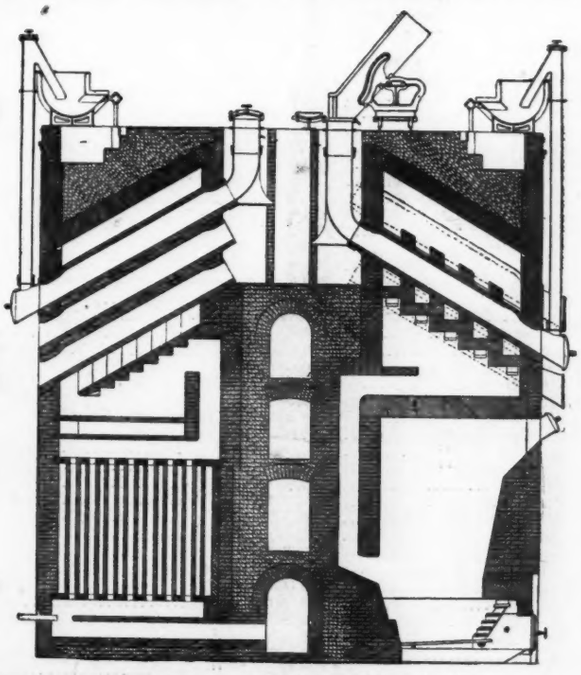

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Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co	20,000
"	20,000
Bombay	400,000
Buffalo, U.S.A., Mutual	750,000
" " **Citizen**	500,000
Brookline, U.S.A.	500,000
Bergen	350,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U.S.A.	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A.	1,000,000
"	1,000,000
" " **Nassau**	1,000,000
Brunner, Mond & Co.	400,000
Cheltenham	2,000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A.	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000

	Capacity. Cubic feet per day.
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A.	350,000
Denver, "	500,000
" "	1,000,000
Dusselldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z	400,000
Darlington	1,250,000
Detroit, U.S.A.	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W	100,000
Grieg	300,000
Georgetown, U.S.A.	250,000
Gluckauf	200,000
Heywood	600,000
Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hamm	200,000
Halle	400,000
Heidelberg	300,000
Hartford, U.S.A.	1,000,000
Ilkeston	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Kidsgrove	100,000
Konigberg	1,000,000
King's Lynn	300,000

LONDON:—

The Gaslight and Coke Co.:	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	560,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A.	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A.	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A.	750,000
Magdeburg	300,000
Memphis, U. S. A	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A.	430,000
Newmarket	150,000
Newark, U.S.A.	680,000
Northfleet	200,000
New York, U.S.A.	2,000,000
Nice	600,000
Newcastle, N. S. W.	200,000
Numea, "	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity. Cubic feet per day.
Ober Schlesian	1,500,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W.	100,000
Prescott	150,000
Providence, U.S.A.	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
Reigate	200,000
Richmond, U.S.A.	250,000
Roxbury, "	500,000
Runcorn Soap Co.	20,000
Rockhampton, N. S. W.	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	200,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W.	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland	1,500,000
St. Josephs, U.S A	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A.	2,000,000
"	2,000,000
"	1,000,000
Laclede	1,000,000
Silesian Coal Co.	600,000
San Francisco, U.S.A.	2,000,000
"	2,000,000
Sheepbridge Coal Co.	40,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
Toledo, U.S.A.	750,000
Toronto	1,000,000
Uxbridge	300,000
Valparaiso	500,000
West Bromwich	1,000,000
Willenhall	250,000
Weston-super-Mare	500,000
Waltham	150,000
Wormwood Scrubs	300,000
Williamsburg, U.S.A.	600,000
"	600,000
Wellington	150,000
Warwick	300,000
Wheeling, U.S.A.	500,000
Walker	300,000
Westgate	100,000
Wilmington, U.S.A.	500,000
Windsor, N. S. W.	100,000
Wolverton	100,000
Wellington, N. Z.	250,000
Whitchurch	175,000
Washington, U.S.A.	2,000,000
Wallasey	750,000
Weimar	150,000
Wurzen	200,000
Worcester, U.S.A.	750,000
Yeadon	500,000
Yeovil	250,000

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Madison City Gas Light Co.	Madison, Wis.
South Bend Gas Light Co.	South Bend, Ind.
Sheboygan National Gas Co.	Sheboygan, Wis.
Salina Gas Light Co.	Salina, Kansas.
The Rathbun Co	Deseronto, Prov. Ont.
Jefferson City Gas Lt. Co	Jefferson City, Mo.
Mankato Gas Light Co.	Mankato, Minn.
Lima Gas Light Co.	Lima, Ohio.
Minneapolis Gas Light and Coke Co.	Minneapolis, Minn.
Bellevue Water and Fuel Gas Light Co.	Bellevue, Campbell County, Ky.
Bucyrus Gas Lt. & Fuel Co.	Bucyrus, Ohio.
Morris Gas Co.	Morris, Ill.
Los Angeles Gas Co.	Los Angeles, Cal.
San Diego Gas Fuel & Electric Lt. Co	San Diego, Cal.
Sioux Falls Gas Co.	Sioux Falls, Dak.
Dakota Gas and Fuel Co.	Grand Forks, Dak.
St. Johns Mutual Gas Co.	St. Johns, Mich.
Stillwater Gas Light Co.	Stillwater, Minn.
St. Paul Gas Light Co	St. Paul, Minn.
Emporia Electric and Gas Light Co.	Emporia, Kas.
Van Wert Gas Light Co.	Van Wert, Ohio.
Lansing Gas Light Co.	Lansing, Mich.
San Francisco Gas Lt. Co.	San Francisco, Cal.
Shelbyville Gas Light Co.	Shelbyville, Ind.
Great Falls Gas Light Co.	Great Falls, N. H.
Belleville Gas Co.	Belleville, Ontario.
Rochester Lt. and Fuel Co.	Rochester, Minn.
Northwestern Gas Light and Coke Co.	Evanston, Ill.
Lincoln Gas Light Co.	Lincoln, Neb.
Davenport Gas Light Co	Davenport, Iowa.
Municipal Gas Co.	Albany, N. Y.
Alliance Gas Light Co.	Alliance, Ohio.
New Gas Light Co.	Janesville, Wis.
*Chicago Gas Light & Coke Co.	Chicago, Ill.
*Joliet Gas Co.	Joliet, Ills.
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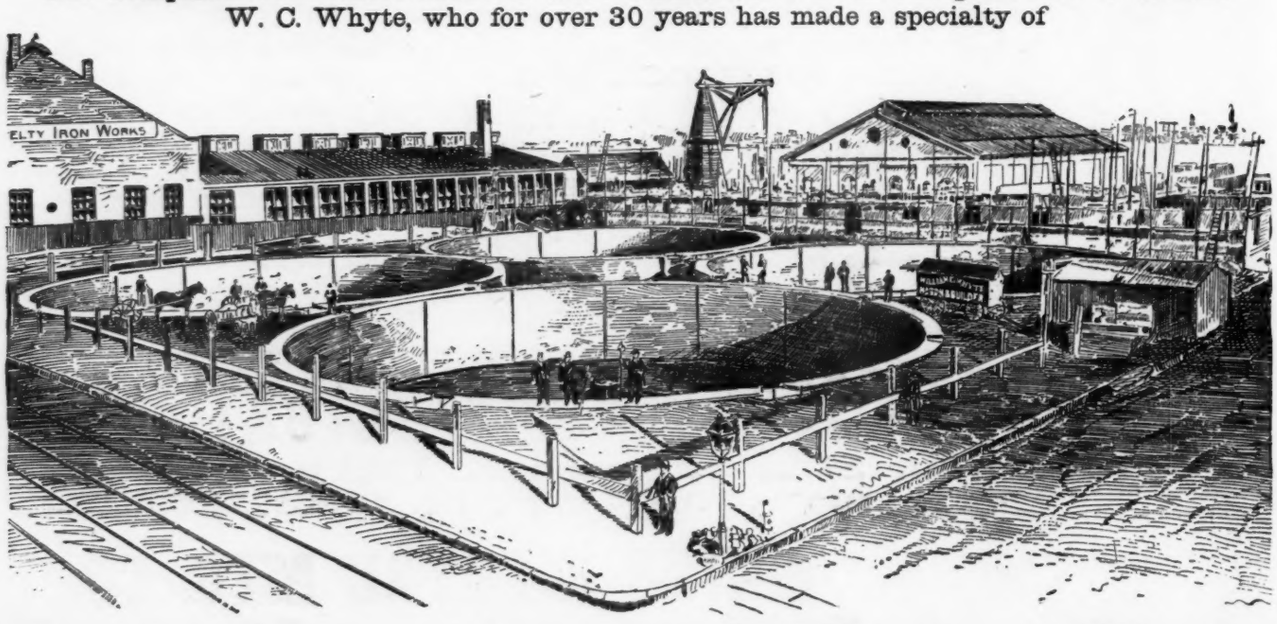

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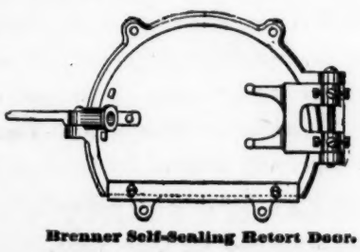

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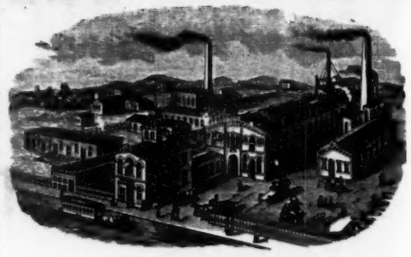

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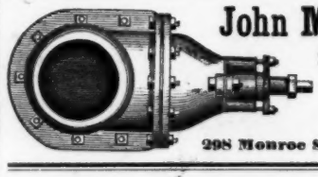

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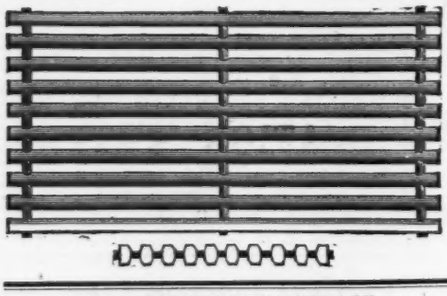

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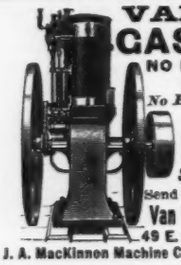

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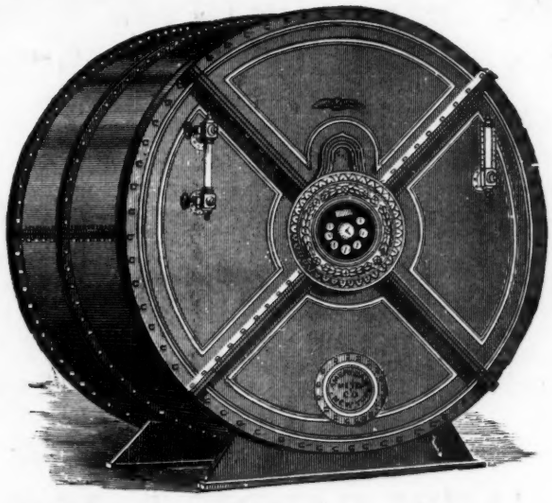

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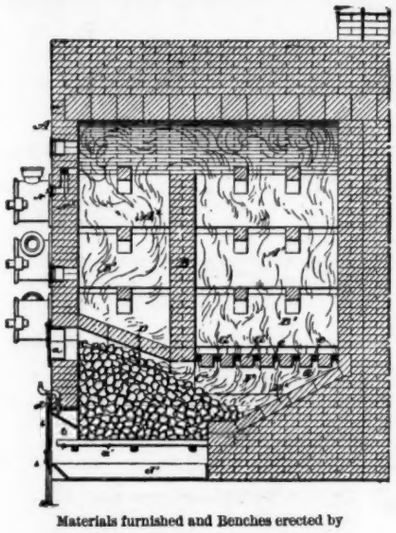

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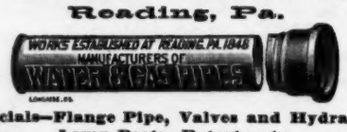

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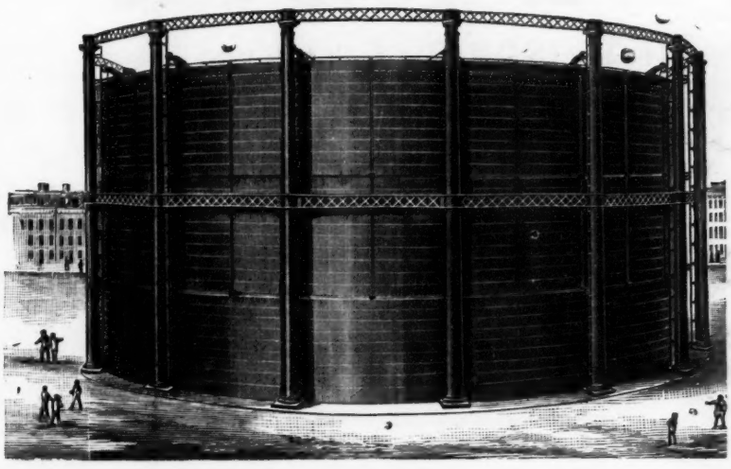

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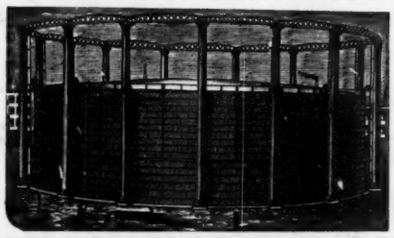

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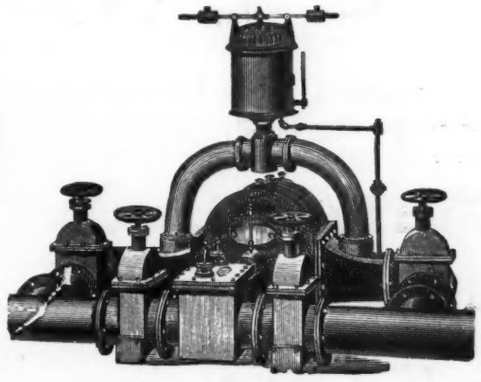

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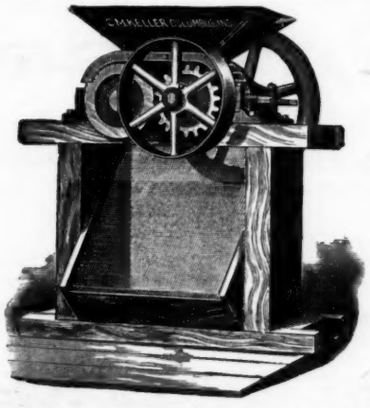

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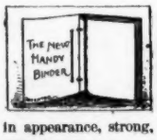

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50-H.P. STEAM ENGINE AND BOILER, Running a Plant of Fifty 2000-C.P. Arc Lamps 12 Hours.		50-H.P. OTTO GAS ENGINE, Running a Plant of Fifty 2000 C.P. Arc Lamps 12 Hours.	
4,500 lbs. Indiana nut and slack, at $1.30 per ton	$2 93	9,200 cu. ft. gas, at 42 cts. per M. (for cost of gas see items below)	$3 86
Engineer, one night, at $50 per month	1 67	Engineer not needed; engine is in care of Electrician or Supt.	....
Trimmer, one day, at $40 per month	1 33	Trimmer, one day, at $40 per month	1 33
Superintendent or Electrician, one day, at $50 per month	1 66	Superintendent or electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05	Waste, etc., one day, at $20 per year	05
Water rent, one day, at $40 per year	11	Water rent dispensed with (cooling water used over and over)	....
Wheeling coal and removing ashes, at $4 per week	58	Handling of coal included in cost of gas	....
100 pairs carbons, at $18.50 per 1000	1 85	100 pairs carbons, at $18.50 per 1,000	1 85
One pint cylinder oil, at 60 cents per gallon	07	One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13	One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$10 38	Total	$8 95

Expenses of depreciation, repairs, and interest omitted, being considered the same in both cases—though depreciation and repairs are much higher with steam on account of boiler and its appurtenances. Cost of gas in the holder we estimate for most of the Middle and Western States as follows: Coal, 30 cts.; labor, 20 cts.; purification, 2 cts.; total, 52 cts. Less coke, 7 cts., and tar, 3 cts.; leaving net cost of gas 42 cts. The items of Superintendence and repairs, being paid for by the gas sold to consumers, need not be charged on extra output for gas engine consumption. Where the cost of gas is higher than here figured, coal for steam use will be found proportionally higher, and final figures of comparison show same amount of saving.

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